Appendix F2
Preliminary Water Quality Management Plan

BERGAMOT SPECIFIC PLAN
INITIAL STUDY

Preliminary Water Quality Management Plan

For:

Citrus Valley

TENTATIVE TRACT NUMBER 20336

Prepared for:

MLC Holdings, Inc.

5 Peters Canyon, Suite 310

Irvine, CA 92606

(949) 372-3319

Contact: Steven Cook

Prepared by:

Huitt-Zollars, Inc.

2603 Main Street, Suite 400

Irvine, CA 92614

(949) 988-5815

Submittal Date: July 2, 2020

Revision Date: July 2, 2020

Approval Date:_____

Project Owner's Certification

This Conceptual Water Quality Management Plan (WQMP) has been prepared for MLC Holdings, Inc. by Huitt-Zollars, Inc. The WQMP is intended to comply with the requirements of the City of Redlands and the NPDES Areawide Stormwater Program requiring the preparation of a WQMP. The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with San Bernardino County's Municipal Storm Water Management Program and the intent of the NPDES Permit for San Bernardino County and the incorporated cities of San Bernardino County within the Santa Ana Region. Once the undersigned transfers its interest in the property, its successors in interest and the city/county shall be notified of the transfer. The new owner will be informed of its responsibility under this WQMP. A copy of the approved WQMP shall be available on the subject site in perpetuity.

"I certify under a penalty of law that the provisions (implementation, operation, maintenance, and funding) of the WQMP have been accepted and that the plan will be transferred to future successors."

.

Project Data			
Permit/Application Number(s):		Grading Permit Number(s):	
Tract/Parcel Map Number(s):	20336	Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			

Owner's Signature		
Owner Name: Steven Cook		
Title	Forward Planning Manager	
Company	MLC Holdings, Inc.	
Address	5 Peters Canyon, Suite 310, Irvine, CA 92606	
Email	steven.cook@mlcholdings.net	
Telephone #	949-292-8487	
Signature	Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):		Grading Permit Number(s):	
Tract/Parcel Map Number(s):	20336	Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			

"The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan were prepared under my oversight and meet the requirements of Regional Water Quality Control Board Order No. R8-2010-0036."

Engineer: Jeffrey Okamoto		PE Stamp Below
Title	Vice President/Managing Principal	
Company	Huitt-Zollars, Inc.	
Address	2603 Main Street, Suite 400, Irvine, CA 92614	
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Telephone #	(949) 988-5815	
Signature		
Date		

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Section 1 Discretionary Permit(s)

Form 1-1 Project Information

Project Name	Citrus Valley – City of Redlands				
Project Owner Contact Name:	Steven Cook				
Mailing Address:	5 Peters Canyon Road, Suite 310 Irvine, CA 92606	E-mail Address:	Steven.Cook@MLCHoldings.net	Telephone:	(949) 372-3319
Permit/Application Number(s):			Tract/Parcel Map Number(s):	20336	
Additional Information/ Comments:					
Description of Project:	The project is located in the City of Redlands, in the County of San Bernardino, California. The proposed development consists of 197 multi-story medium-density single family residential lots, 120 multi-story high-density single family residential lots, and 4 lettered lots (parks) to be dedicated. The proposed tract would develop approximately 58.67 acres of land into numbered lots and public streets. The existing site consists of 56.4 acres of citrus groves. The terrain predominately slopes north westerly towards the northwest corner of the parcel. The parcel lies on a floodplain south of the Santa Ana River in an HCOC Exempt Area. Existing onsite runoff (DA1 40.38 acres and DA2 18.29 acres) drains via surface flow west towards a drainage channel that flows along the western border of the parcel. This channel eventually drains to the Santa Ana River north of the project site. The reach of the Santa Ana River the site drains to is an EHM channel allowing the project area to be HCOC exempt. In the proposed condition, all lots will be graded for runoff to be captured in onsite catch basins. The catch basins will be sized to capture all onsite runoff and convey it to the proposed onsite storm drain infrastructure and infiltration basins. Runoff will be infiltrated into the subsurface soils. Underlying soils are natural alluvial soils consisting of medium dense fine to medium-grained silty sands and sandy silt. These soils are classified as Hydraulic Soil Group A over the entire site by NRCS (Please see Attachment D for NRCS Soils Report). Site specific geotechnical report, including infiltration testing, have been performed to confirm the feasibility to infiltrate and is included as part of this submittal. This project proposes the construction of on-site stormwater infrastructure including curb inlets, curb and gutter, and two aboveground infiltration basins located in the site's western parklands. Additionally, off tract public street improvements of Street N and Domestic Ave including street widening, sidewalks, and curb and gutter are proposed as part of this project. The project site is completely bordered on the west by a drainage channel that continues north to outlet into the Santa Ana River. Both of the proposed basins will have overflow				

	structures that discharge into this channel. To the south is Citrus Valley High School and to the east, tract housing. Main access points onto the project site will be to the north and south on Street N and Domestic Ave respectively. These access points will have cross gutters installed to prevent flows from Texas St and offsite flows from running onto the site. Approximately 1,352,000 sq. ft. of the project site will consist of impervious areas such as roofs, streets, and driveways. Approximately 1,100,000 sq. ft. will be landscaped pervious area in parklands, open spaces, and lawns.
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	

Section 2 Project Description

2.1 Project Information

This section of the WQMP should provide the information listed below. The information provided for Conceptual WQMP should give sufficient detail to identify the major proposed site design and LID BMPs and other anticipated water quality features that impact site planning. Final Project WQMP must specifically identify all BMP incorporated into the final site design and provide other detailed information as described herein.

The purpose of this information is to help determine the applicable development category, pollutants of concern, watershed description, and long term maintenance responsibilities for the project, and any applicable water quality credits. This information will be used in conjunction with the information in Section 3, Site Description, to establish the performance criteria and to select the LID BMP or other BMP for the project or other alternative programs that the project will participate in, which are described in Section 4.

Form 2.1-1 Description of Proposed Project

1 Development Category (Select all that apply):

☐ Significant re-development involving the addition or replacement of 5,000 ft² or more of impervious surface on an already developed site	☒ New development involving the creation of 10,000 ft² or more of impervious surface collectively over entire site	☐ Automotive repair shops with standard industrial classification (SIC) codes 5013, 5014, 5541, 7532- 7534, 7536-7539	☐ Restaurants (with SIC code 5812) where the land area of development is 5,000 ft² or more
☐ Hillside developments of 5,000 ft² or more which are located on areas with known erosive soil conditions or where the natural slope is 25 percent or more	☐ Developments of 2,500 ft² of impervious surface or more adjacent to (within 200 ft) or discharging directly into environmentally sensitive areas or waterbodies listed on the CWA Section 303(d) list of impaired waters.	☒ Parking lots of 5,000 ft² or more exposed to storm water	☐ Retail gasoline outlets that are either 5,000 ft² or more, or have a projected average daily traffic of 100 or more vehicles per day

☐ Non-Priority / Non-Category Project *May require source control LID BMPs and other LIP requirements. Please consult with local jurisdiction on specific requirements*.

2 Project Area (ft2):	2,458,091	**3** Number of Dwelling Units:	317	**4** SIC Code:	

5 Is Project going to be phased? Yes ☐ No ☒ *If yes, ensure that the WQMP evaluates each phase as a distinct DA, requiring LID BMPs to address runoff at time of completion.*

6 Does Project include roads? Yes ☐ No ☒ *If yes, ensure that applicable requirements for transportation projects are addressed (see Appendix A of TGD for WQMP)*

2.2 Property Ownership/Management

Describe the ownership/management of all portions of the project and site. State whether any infrastructure will transfer to public agencies (City, County, Caltrans, etc.) after project completion. State if a homeowners or property owners association will be formed and be responsible for the long-term maintenance of project stormwater facilities. Describe any lot-level stormwater features that will be the responsibility of individual property owners.

Form 2.2-1 Property Ownership/Management

Describe property ownership/management responsible for long-term maintenance of WQMP stormwater facilities:

The City of Redlands will be responsible for the maintenance of all public streets, parkway landscaping, open space lots, LID BMPs, and underground private storm drains. The LID BMPs include two aboveground infiltration basins both located within lettered Lot A at the of the northeast corner of the proposed Baseball Field and just west of Street M cul-de-sac, respectively.

At the completion of the project, all streets will be publicly dedicated, and a covenant agreement will be prepared to transfer the maintenance responsibility of the LID BMPs to the City.

The maintenance of private lots will be of the responsibility of private homeowners.

2.3 Potential Stormwater Pollutants

Determine and describe expected stormwater pollutants of concern based on land uses and site activities (refer to Table 3-3 in the TGD for WQMP).

Form 2.3-1 Pollutants of Concern			
Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☒	N ☐	
Nutrients - Phosphorous	E ☒	N ☐	
Nutrients - Nitrogen	E ☒	N ☐	
Noxious Aquatic Plants	E ☐	N ☒	
Sediment	E ☒	N ☐	
Metals	E ☒	N ☐	
Oil and Grease	E ☒	N ☐	
Trash/Debris	E ☒	N ☐	
Pesticides / Herbicides	E ☒	N ☐	Pesticides, petroleum hydrocarbons, and vegetative debris are the most likely sources of organic contamination.
Organic Compounds	E ☒	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

2.4 Water Quality Credits

A water quality credit program is applicable for certain types of development projects if it is not feasible to meet the requirements for on-site LID. Proponents for eligible projects, as described below, can apply for water quality credits that would reduce project obligations for selecting and sizing other treatment BMP or participating in other alternative compliance programs. Refer to Section 6.2 in the TGD for WQMP to determine if water quality credits are applicable for the project

Form 2.4-1 Water Quality Credits

1 Project Types that Qualify for Water Quality Credits: *Select all that apply*			
☐ Redevelopment projects that reduce the overall impervious footprint of the project site. [Credit = % impervious reduced]	Higher density development projects ☐ Vertical density [20%] ☐ 7 units/ acre [5%]	☐ Mixed use development, (combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that demonstrate environmental benefits not realized through single use projects) [20%]	☐ Brownfield redevelopment (redevelop real property complicated by presence or potential of hazardous
☐ Redevelopment projects in established historic district, historic preservation area, or similar significant core city center areas [10%]	☐ Transit-oriented developments (mixed use residential or commercial area designed to maximize access to public transportation) [20%]	☐ In-fill projects (conversion of empty lots & other underused spaces < 5 acres, substantially surrounded by urban land uses, into more beneficially used spaces, such as residential or commercial areas) [10%]	☐ Live-Work developments (variety of developments designed to support residential and vocational needs) [20%]
2 Total Credit % *(Total all credit percentages up to a maximum allowable credit of 50 percent)*			
Description of Water Quality Credit Eligibility (if applicable)	Proposed project site density is 5.7 DU/AC. No water quality credits apply.		

Section 3 Site and Watershed Description

Describe the project site conditions that will facilitate the selection of BMP through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and sub-watershed DMAs) is conveyed to the site outlet(s). Refer to Section 3.2 in the TGD for WQMP. Complete form 3.2 for each DA on the project site.

Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude 34.0865°	Longitude -117.1951°	Thomas Bros Map page 608

1 San Bernardino County climatic region: ☒ Valley ☐ Mountain

2 Does the site have more than one drainage area (DA): Yes☒ No☐ *If no, proceed to Form 3-2. If yes, then use this form to show a conceptual schematic describing DMAs and hydrologic feature connecting DMAs to the site outlet(s). An example is provided below that can be modified for proposed project or a drawing clearly showing DMA and flow routing may be attached*

Conveyance	DA 1: Runoff from Streets B through H and L will flow via street flow to catch basins found throughout the development. Water will then be conveyed to the primary infiltration basin found in the open space on the west-side of the site. Street flows from Domestic Ave will also be captured at an inlet at the end of the street and piped to the main infiltration basin. DA 2: Runoff from Streets J, K, I, M and N will flow via street and pipe flow to a catch basin at the end of the cul-de-sac on Street M. Water will then be conveyed to a secondary infiltration basin located at the northwest corner of the proposed site.
DA 1 to Outlet 1, DA 2 to Outlet 2	Areas of all DAs total 58.67acres. The lots and streets are designed to surface flow onsite runoff along street curbs and into sized catch basins. Runoff captured by the catch basins is conveyed to the onsite proposed storm drain infrastructure which is connected to various aboveground infiltration basins. The basins will have structures that enable overflow to flow into the drainage channel that forms the west boundary of the project site. The overflow Outlet 1 from the main infiltration basin discharges into the drainage channel draining north to the Santa Ana River. Overflow discharges from Outlet 2 from the secondary infiltration basin are directed to the same drainage channel that runs north all the way to the Santa Ana River.

Form 3-2 Existing Hydrologic Characteristics for Drainage Area (DA-1)				
For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA 1A			
1 DMA drainage area (ft^2)	1,758,822			
2 Existing site impervious area (ft^2)	0			
3 Antecedent moisture condition *For valley areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	II			
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	B			
5 Longest flowpath length (ft)	2303			
6 Longest flowpath slope (ft/ft)	0.024			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	*Orchards, Evergreen*			
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*	Poor (Please see Attachment D for image supporting the poor condition)			

Form 3-2 Existing Hydrologic Characteristics for Drainage Area (DA-2)				
For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA 2A			
1 DMA drainage area (ft^2)	796,843			
2 Existing site impervious area (ft^2)	0			
3 Antecedent moisture condition *For valley areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	II			
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	B			
5 Longest flowpath length (ft)	2120			
6 Longest flowpath slope (ft/ft)	0.023			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	*Orchards, Evergreens*			
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*	Poor (Please see Attachment D for image supporting the poor condition)			

Form 3-3 Watershed Description for Drainage Area

Receiving waters *Refer to Watershed Mapping Tool - http://permitrack.sbcounty.gov/wap/ See 'Drainage Facilities" link at this website*	Santa Ana River, Reach 5
Applicable TMDLs *Refer to Local Implementation Plan*	Indicator Bacteria TMDL (USEPA) for Santa Ana River, Reach 3
303(d) listed impairments *Refer to Local Implementation Plan and Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/ and State Water Resources Control Board website – http://www.waterboards.ca.gov/santaana/water_issues/programs/tmdl/index.shtml*	There are no downstream drainage segments with 303(d) listed pollutants that are subject to TMDLs. Per 2010 Integrated Report (Clean Water Act Section 303(d) Report) Santa Ana River Reach 4 is 303(d) listed for pathogens Santa Ana River Reach 3 is 303(d) listed for copper, lead and pathogens Santa Ana River Reach 2 is 303(d) listed for indicator bacteria
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	None
Unlined Downstream Water Bodies *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	None
Hydrologic Conditions of Concern	☐ Yes *Complete Hydrologic Conditions of Concern (HCOC) Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-10 in submittal* ☒ No
Watershed–based BMP included in a RWQCB approved WAP	☐ Yes *Attach verification of regional BMP evaluation criteria in WAP* • *More Effective than On-site LID* • *Remaining Capacity for Project DCV* • *Upstream of any Water of the US* • *Operational at Project Completion* • *Long-Term Maintenance Plan* ☒ No

Section 4 Best Management Practices (BMP)

4.1 Source Control BMP

4.1.1 Pollution Prevention

Non-structural and structural source control BMP are required to be incorporated into all new development and significant redevelopment projects. Form 4.1-1 and 4.1-2 are used to describe specific source control BMPs used in the WQMP or to explain why a certain BMP is not applicable. Table 7-3 of the TGD for WQMP provides a list of applicable source control BMP for projects with specific types of potential pollutant sources or activities. The source control BMP in this table must be implemented for projects with these specific types of potential pollutant sources or activities. The preparers of this WQMP have reviewed the source control BMP requirements for new development and significant redevelopment projects. The preparers have also reviewed the specific BMP required for project as specified in Forms 4.1-1 and 4.1-2. All applicable non-structural and structural source control BMP shall be implemented in the project.

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs	☒	☐	Prior to building occupancy, builder will provide educational materials to the private homeowners to inform them of their potential impacts to downstream water quality. Should the private homeowner rent a property to a tenant, the private homeowner will be responsible to provide the educational materials to the tenant.
N2	Activity Restrictions	☒	☐	Activity restrictions to minimize potential impacts to water quality and with the purpose of protecting water quality will be prescribed by the project's Covenant, Conditions and Restrictions (CC&Rs), or other equally effective measure. Activities that violate the ordinances in Chapter 13.54 of the City of Redlands Municipal Code as well as activities for which adequate BMPs have not been provided will be restricted.
N3	Landscape Management BMPs	☒	☐	Maintenance activities for landscape areas shall be consistent with County and manufacturer guidelines for fertilizer and pesticide use. Single-family homeowners will be responsible for maintaining privately owned landscaped areas. Compliance to be ensured by the HOA. Parkways, common areas, and landscaped parking islands will be maintained by the City of Redlands.

Form 4.1-1 Non-Structural Source Control BMPs				
N4	BMP Maintenance	☒	☐	Regular inspections and removal of debris and sediment buildup, overgrown vegetation will be performed by the City at all drainage inlets, manholes, and the two infiltration basins.
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	The proposed residential development will not generate waste subject to Title 22 CCR Compliance.
N6	Local Water Quality Ordinances	☒	☐	Prior to obtaining a grading or building permit a Storm Water Quality Management Plan (SWQMP) must be provided to the city Engineer on a document provided by the City of Redlands. Once the SWQMP is approved the owner of the project shall submit a SWQMP agreement. Chapter 13.54 of the Municipal Code lists the ordinances that shall be complied with. (https://codelibrary.amlegal.com/codes/redlandsca/latest/redlands_ca/0-0-0-10848)
N7	Spill Contingency Plan	☐	☒	Spill plans are not required for single family residential lots.
N8	Underground Storage Tank Compliance	☐	☒	Underground storage tanks are not part of this project.
N9	Hazardous Materials Disclosure Compliance	☐	☒	Hazardous materials are not allowed to be stored on the site.

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N10	Uniform Fire Code Implementation	☐	☒	The proposed residential project will not store toxic or highly toxic compressed gases.
N11	Litter/Debris Control Program	☒	☐	Litter control onsite will include the use of litter patrols, violation reporting and clean up during landscaping maintenance activities and as needed to ensure good housekeeping of the project's common areas.
N12	Employee Training	☒	☐	All employees, contractors and subcontractors of the City and the HOA shall be trained on the proper use and staging of landscaping and other materials with the potential to impact runoff and proper clean-up of spills and materials.
N13	Housekeeping of Loading Docks	☐	☒	Loading Docks are not part of this project.
N14	Catch Basin Inspection Program	☒	☐	As required by the TGD, at least 80% of the project's drainage facilities shall be inspected, cleaned/maintained annually by the City, with 100% of facilities inspected and maintained within a two-year period. Drainage facilities include catch basins (storm drain inlets), infiltration/detention basins, sediment chambers, open drainage channels, and lift stations.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☐	☒	There are no private streets or parking lots in this project.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	No other non-structural measures required.
N17	Comply with all other applicable NPDES permits	☒	☐	Compliance with requirements outlined in the SWPPP including sediment and erosion control measures and housekeeping BMPs shall be followed.

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S1	Provide storm drain system stencilling and signage (CASQA New Development BMP Handbook SD-13)	☒	☐	The stencil shall be blue on a white background with lettering 2- 1/2 " in height and reading "No Dumping – Drains to river". A fish or similar water dependent creature silhouette may be included subject to City approval. In lieu of a stencil, a catch basin curb marker, circular or rectangular, at least 4" in height or diameter, may be used. The message will be the same and is subject to City approval. A painted circular stencil shall not be bigger than 8" in diameter. Legibility will be checked and repainted annually.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	Project does not propose outdoor storage areas.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	Trash shall be consolidated at designated waste storage areas. Trash generated from parks shall be collected from available waste receptacles by the city's waste management. Designated waste storage areas and waste receptacles shall be designed per CASQA standards.
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	☒	☐	In conjunction with routine landscaping maintenance activities, inspect irrigation for signs of leaks, overspray and repair or adjust accordingly. Adjust system cycle to accommodate seasonal fluctuations in water demand and temperatures. Ensure use of native or drought tolerant/non-invasive plant species to minimize water consumption. To reduce excessive irrigation runoff, the following methods shall be implemented: 1. Employing rain shutoff devices to prevent irrigation after precipitation. 2. Designing irrigation systems to each landscape area's specific water requirements. 3. Using flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines. 4. The timing and application methods of irrigation water shall be designed to minimize the runoff of excess irrigation water into the municipal storm drain system. 5. Employing other comparable, equally effective, methods to reduce irrigation water runoff. Mulches (such as wood chips or shredded wood

				products) in planter areas without ground cover minimize sediment in runoff. If any devices are battery powered, replace the batteries yearly or replace them as needed, whichever occurs first.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	Landscape areas are depressed. The finish grade of landscape areas is at least one to two inches below hard surfaces.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	Energy dissipation measures, or riprap pads, will be installed at the storm drain inlets into the infiltration basins to protect basin slopes and bottom against erosion. Proper energy dissipation will be incorporated at the outlet of the project storm drain into the existing concrete-lined trapezoidal channel, if deemed necessary.
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	Project does not propose dock areas.
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	Project does not propose maintenance bays.
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	Project does not propose vehicle wash areas.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	Project does not propose outdoor processing area.
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	Project does not propose equipment wash areas.
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	Project does not propose fueling areas.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	There are no hillsides in the project area.
S14	Wash water control for food preparation areas	☐	☒	Project does not propose food preparation areas.
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	Project does not propose car wash racks.

4.1.2 Preventative LID Site Design Practices

Site design practices associated with new LID requirements in the MS4 Permit should be considered in the earliest phases of a project. Preventative site design practices can result in smaller DCV for LID BMP and hydromodification control BMP by reducing runoff generation. Describe site design and drainage plan including:

♣ A narrative of site design practices utilized or rationale for not using practices

♣ A narrative of how site plan incorporates preventive site design practices

♣ Include an attached Site Plan layout which shows how preventative site design practices are included in WQMP

Refer to Section 5.2 of the TGD for WQMP for more details.

Form 4.1-3 Preventative LID Site Design Practices Checklist

Site Design Practices *If yes, explain how preventative site design practice is addressed in project site plan. If no, other LID BMPs must be selected to meet targets*
Minimize impervious areas: Yes ☒ No ☐ Explanation: Driveways, street, sidewalk, drive isle, and parking stall will be incorporated to the minimum width and length allowed by City standards. Also, the usage of vertical building (2 story) and clustered building minimizes impervious areas.
Maximize natural infiltration capacity: Yes ☒ No ☐ Explanation: Infiltration basins are implemented where feasible. The unnecessary compaction of soils will be minimized during construction activities by minimizing the construction footprint and staking off the perimeter of the infiltration basins.
Preserve existing drainage patterns and time of concentration: Yes ☒ No ☐ Explanation: The drainage patterns of the project area will generally not be modified due to development. Flows will still be directed towards the concrete channel located between TTM 20336 and the Freeway. Since an onsite underground storm drainage system is proposed, existing drainage patterns might be altered at the scale of a cluster. However, the time of concentration resulting from the project improvements will be mitigated through detention by the proposed infiltration/detention basins, as well as providing additional protection against flooding.
Disconnect impervious areas: Yes ☒ No ☐ Explanation: Runoff from the roofs is collected by downspouts and discharged over pervious areas.
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation: The existing vegetation on the project site will not be protected as the entire site will be graded to allow for new construction. There are no sensitive areas within the limits of grading.
Re-vegetate disturbed areas: Yes ☒ No ☐ Explanation: This project proposes the installation of 15.2 acres of landscaped park space as well as landscaped lots to the maximum extent practicable. Minimum impervious improvements will be incorporated, such as pedestrian walkways, a parking lot, and amenities.
Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: Construction plans will identify that heavy equipment is prohibited in the vicinity of the proposed infiltration chambers.

Utilize vegetated drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation: The entirety of the project site (excluding public streets Street N and Domestic Ave) will drain to the proposed infiltration/detention basin. Because of the significant grade differential between the east and west boundaries of the project, as well as the potential for flooding onto residential properties, the implementation of vegetated swales is not included as part of the design.
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☒ No ☐ Explanation: The use of heavy machinery is not anticipated during construction due to the minimal earthwork. Construction equipment with low bearing loads will be used in the vicinity of the two infiltration basins. The perimeter of the infiltration basins shall be staked off during construction.

4.2 Project Performance Criteria

The purpose of this section of the Project WQMP is to establish targets for post development hydrology based on performance criteria specified in the MS4 Permit. These targets include runoff volume for water quality control (referred to as LID design capture volume), and runoff volume, time of concentration, and peak runoff for protection of any downstream waterbody segments with a HCOC. **If the project has more than one outlet for stormwater runoff, then complete additional versions of these forms for each DA / outlet.**

Methods applied in the following forms include:

♣ For LID BMP Design Capture Volume (DCV), the San Bernardino County Stormwater Program requires use of the P6 method (MS4 Permit Section XI.D.6a.ii) – Form 4.2-1

♣ For HCOC pre- and post-development hydrologic calculation, the San Bernardino County Stormwater Program requires the use of the Rational Method (San Bernardino County Hydrology Manual Section D). Forms 4.2-2 through Form 4.2-5 calculate hydrologic variables including runoff volume, time of concentration, and peak runoff from the project site pre- and post-development using the Hydrology Manual Rational Method approach. For projects greater than 640 acres (1.0 mi2), the Rational Method and these forms should not be used. For such projects, the Unit Hydrograph Method (San Bernardino County Hydrology Manual Section E) shall be applied for hydrologic calculations for HCOC performance criteria.

Refer to Section 4 in the TGD for WQMP for detailed guidance and instructions.

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1)

1 Project area DA 1 (ft^2): 1,758,822	**2** Imperviousness after applying preventative site design practices (Imp%): 38.9%	**3** Runoff Coefficient (Rc): 0.274 *$R_c = 0.858(Imp\%)^{\wedge 3} - 0.78(Imp\%)^{\wedge 2} + 0.774(Imp\%) + 0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.480 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.711 *P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)*		
6 Drawdown Rate *Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.*		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft^3): 56,126 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 2)

1 Project area DA 1 (ft^2): 796,843	**2** Imperviousness after applying preventative site design practices (Imp%): 42.7%	**3** Runoff Coefficient (Rc): 0.295 *$R_c = 0.858(Imp\%)^{\wedge 3} - 0.78(Imp\%)^{\wedge 2} + 0.774(Imp\%) + 0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.480 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.711 *P_6 = Item 4 * C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)*		
6 Drawdown Rate *Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.*		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft^3): 27,439 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

Form 4.2-2 Summary of HCOC Assessment (DA 1)

Does project have the potential to cause or contribute to an HCOC in a downstream channel: Yes ☐ No ☒

Go to: *http://permitrack.sbcounty.gov/wap/*

If "Yes", then complete HCOC assessment of site hydrology for 2yr storm event using Forms 4.2-3 through 4.2-5 and insert results below

(Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual)

If "No," then proceed to Section 4.3 Project Conformance Analysis

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	**1** *Form 4.2-3 Item 12*	**2** *Form 4.2-4 Item 13*	**3** *Form 4.2-5 Item 10*
Post-developed	**4** *Form 4.2-3 Item 13*	**5** *Form 4.2-4 Item 14*	**6** *Form 4.2-5 Item 14*
Difference	**7** *Item 4 – Item 1*	**8** *Item 2 – Item 5*	**9** *Item 6 – Item 3*
Difference (as % of pre-developed)	**10** *Item 7 / Item 1*	**11** *Item 8 / Item 2*	**12** *Item 9 / Item 3*

Form 4.2-3 HCOC Assessment for Runoff Volume (DA 1)

Weighted Curve Number Determination for: Pre-developed DA								
1a Land Cover type								
2a Hydrologic Soil Group (HSG)								
3a DMA Area, ft^2 *sum of areas of DMA should equal area of DA*								
4a Curve Number (CN) *use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*								
Weighted Curve Number Determination for: Post-developed DA								
1b Land Cover type								
2b Hydrologic Soil Group (HSG)								
3b DMA Area, ft^2 *sum of areas of DMA should equal area of DA*								
4b Curve Number (CN) *use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*								

5 Pre-Developed area-weighted CN:	**7** Pre-developed soil storage capacity, S (in): *S = (1000 / Item 5) - 10*	**9** Initial abstraction, I_a (in): *I_a = 0.2 * Item 7*
6 Post-Developed area-weighted CN:	**8** Post-developed soil storage capacity, S (in): *S = (1000 / Item 6) - 10*	**10** Initial abstraction, I_a (in): *I_a = 0.2 * Item 8*

11 Precipitation for 2 yr, 24 hr storm (in):
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

12 Pre-developed Volume (ft^3):
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 9)^2 / ((Item 11 – Item 9 + Item 7)*

13 Post-developed Volume (ft^3):
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 10)^2 / ((Item 11 – Item 10 + Item 8)*

14 Volume Reduction needed to meet HCOC Requirement, (ft^3):
*V_{HCOC} = (Item 13 * 0.95) – Item 12*

Form 4.2-4 HCOC Assessment for Time of Concentration (DA 1)

Compute time of concentration for pre and post developed conditions for each DA *(For projects using the Hydrology Manual complete the form below)*

Variables	Pre-developed DA 1 *Use additional forms if there are more than 4 DMA*				Post-developed DA 1 *Use additional forms if there are more than 4 DMA*				
1 Length of flowpath (ft) *Use Form 3-2 Item 5 for pre-developed condition*									
2 Change in elevation (ft)									
3 Slope (ft/ft), S_o = *Item 2 / Item 1*									
4 Land cover									
5 Initial DMA Time of Concentration (min) *Appendix C-1 of the TGD for WQMP*									
6 Length of conveyance from DMA outlet to project site outlet (ft) *May be zero if DMA outlet is at project site outlet*									
7 Cross-sectional area of channel (ft^2)									
8 Wetted perimeter of channel (ft)									
9 Manning's roughness of channel (n)									
10 Channel flow velocity (ft/sec) V_{fps} = *(1.49 / Item 9) * (Item 7/Item 8)^0.67 * (Item 3)^0.5*									
11 Travel time to outlet (min) T_t = *Item 6 / (Item 10 * 60)*									
12 Total time of concentration (min) T_c = *Item 5 + Item 11*									

13 Pre-developed time of concentration (min): *Minimum of Item 12 pre-developed DMA*

14 Post-developed time of concentration (min): *Minimum of Item 12 post-developed DMA*

15 Additional time of concentration needed to meet HCOC requirement (min): 5.7 $T_{C\text{-}HCOC}$ = *(Item 13 * 0.95) – Item 14*

Form 4.2-5 HCOC Assessment for Peak Runoff (DA 1)

Compute peak runoff for pre- and post-developed conditions

Variables		Pre-developed DMA to Project Outlet			Post-developed DMA to Project Outlet		
1 Rainfall Intensity for storm duration equal to time of concentration *I_{peak} = 10^(LOG Form 4.2-1 Item 4 - 0.6 LOG Form 4.2-4 Item 5 /60)*							
2 Drainage Area of each DMA (Acres) *For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*							
3 Ratio of pervious area to total area *For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*							
4 Pervious area infiltration rate (in/hr) *Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP*							
5 Maximum loss rate (in/hr) *F_m = Item 3 * Item 4* *Use area-weighted F_m from DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*							
6 Peak Flow from DMA (cfs) *Q_p =Item 2 * 0.9 * (Item 1 - Item 5)*							
7 Time of concentration adjustment factor for other DMA to site discharge point *Form 4.2-4 Item 12 DMA / Other DMA upstream of site discharge point (If ratio is greater than 1.0, then use maximum value of 1.0)*	DA 1	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
	DA 2	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
	DA 3	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*

8 Pre-developed Q_p at T_c for DMA A: n/a *Q_p = Item 6_{DMAA} + [Item 6_{DMAB} * (Item 1_{DMAA} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAA/2}$] + [Item 6_{DMAC} * (Item 1_{DMAA} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAA/3}$]*	**9** Pre-developed Q_p at T_c for DMA B: n/a *Q_p = Item 6_{DMAB} + [Item 6_{DMAA} * (Item 1_{DMAB} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAB/1}$] + [Item 6_{DMAC} * (Item 1_{DMAB} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAB/3}$]*	**10** Pre-developed Q_p at T_c for DMA C: n/a *Q_p = Item 6_{DMAC} + [Item 6_{DMAA} * (Item 1_{DMAC} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAC/1}$] + [Item 6_{DMAB} * (Item 1_{DMAC} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAC/2}$]*
10 Peak runoff from pre-developed condition confluence analysis (cfs): *Maximum of Item 8, 9, and 10 (including additional forms as needed)*		
11 Post-developed Q_p at T_c for DMA A: *Same as Item 8 for post-developed values*	**12** Post-developed Q_p at T_c for DMA B: n/a *Same as Item 9 for post-developed values*	**13** Post-developed Q_p at T_c for DMA C: n/a *Same as Item 10 for post-developed values*
14 Peak runoff from post-developed condition confluence analysis (cfs): *Maximum of Item 11, 12, and 13 (including additional forms as needed)*		
15 Peak runoff reduction needed to meet HCOC Requirement (cfs): *$Q_{p\text{-}HCOC}$ = (Item 14 * 0.95) – Item 10*		

Form 4.2-2 Summary of HCOC Assessment (DA 2)

Does project have the potential to cause or contribute to an HCOC in a downstream channel: Yes ☐ No ☒

Go to: *http://permitrack.sbcounty.gov/wap/*

If "Yes", then complete HCOC assessment of site hydrology for 2yr storm event using Forms 4.2-3 through 4.2-5 and insert results below

(Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual)

If "No," then proceed to Section 4.3 Project Conformance Analysis

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	**1** *Form 4.2-3 Item 12*	**2** *Form 4.2-4 Item 13*	**3** *Form 4.2-5 Item 10*
Post-developed	**4** *Form 4.2-3 Item 13*	**5** *Form 4.2-4 Item 14*	**6** *Form 4.2-5 Item 14*
Difference	**7** *Item 4 – Item 1*	**8** *Item 2 – Item 5*	**9** *Item 6 – Item 3*
Difference (as % of pre-developed)	**10** *Item 7 / Item 1*	**11** *Item 8 / Item 2*	**12** *Item 9 / Item 3*

Form 4.2-3 HCOC Assessment for Runoff Volume (DA 2)

Weighted Curve Number Determination for: Pre-developed DA								
1a Land Cover type								
2a Hydrologic Soil Group (HSG)								
3a DMA Area, ft^2 *sum of areas of DMA should equal area of DA*								
4a Curve Number (CN) *use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*								
Weighted Curve Number Determination for: Post-developed DA								
1b Land Cover type								
2b Hydrologic Soil Group (HSG)								
3b DMA Area, ft^2 *sum of areas of DMA should equal area of DA*								
4b Curve Number (CN) *use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*								

5 Pre-Developed area-weighted CN:	**7** Pre-developed soil storage capacity, S (in): *S = (1000 / Item 5) - 10*	**9** Initial abstraction, I_a (in): *I_a = 0.2 * Item 7*
6 Post-Developed area-weighted CN:	**8** Post-developed soil storage capacity, S (in): *S = (1000 / Item 6) - 10*	**10** Initial abstraction, I_a (in): *I_a = 0.2 * Item 8*

11 Precipitation for 2 yr, 24 hr storm (in):
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

12 Pre-developed Volume (ft^3):
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 9)^2 / ((Item 11 – Item 9 + Item 7)*

13 Post-developed Volume (ft^3):
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 10)^2 / ((Item 11 – Item 10 + Item 8)*

14 Volume Reduction needed to meet HCOC Requirement, (ft^3):
*V_{HCOC} = (Item 13 * 0.95) – Item 12*

Form 4.2-4 HCOC Assessment for Time of Concentration (DA 2)

Compute time of concentration for pre and post developed conditions for each DA *(For projects using the Hydrology Manual complete the form below)*

Variables	Pre-developed DA 1 *Use additional forms if there are more than 4 DMA*				Post-developed DA 1 *Use additional forms if there are more than 4 DMA*				
1 Length of flowpath (ft) *Use Form 3-2 Item 5 for pre-developed condition*									
2 Change in elevation (ft)									
3 Slope (ft/ft), S_o = *Item 2 / Item 1*									
4 Land cover									
5 Initial DMA Time of Concentration (min) *Appendix C-1 of the TGD for WQMP*									
6 Length of conveyance from DMA outlet to project site outlet (ft) *May be zero if DMA outlet is at project site outlet*									
7 Cross-sectional area of channel (ft^2)									
8 Wetted perimeter of channel (ft)									
9 Manning's roughness of channel (n)									
10 Channel flow velocity (ft/sec) V_{fps} = *(1.49 / Item 9) * (Item 7/Item 8)^0.67 * (Item 3)^0.5*									
11 Travel time to outlet (min) T_t = *Item 6 / (Item 10 * 60)*									
12 Total time of concentration (min) T_c = *Item 5 + Item 11*									

13 Pre-developed time of concentration (min): *Minimum of Item 12 pre-developed DMA*

14 Post-developed time of concentration (min): *Minimum of Item 12 post-developed DMA*

15 Additional time of concentration needed to meet HCOC requirement (min): 5.7 $T_{C\text{-}HCOC}$ = *(Item 13 * 0.95) – Item 14*

Form 4.2-5 HCOC Assessment for Peak Runoff (DA 2)

Compute peak runoff for pre- and post-developed conditions

Variables		Pre-developed DMA to Project Outlet			Post-developed DMA to Project Outlet		
1 Rainfall Intensity for storm duration equal to time of concentration *I_{peak} = 10^(LOG Form 4.2-1 Item 4 - 0.6 LOG Form 4.2-4 Item 5 /60)*							
2 Drainage Area of each DMA (Acres) *For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*							
3 Ratio of pervious area to total area *For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*							
4 Pervious area infiltration rate (in/hr) *Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP*							
5 Maximum loss rate (in/hr) *F_m = Item 3 * Item 4* *Use area-weighted F_m from DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*							
6 Peak Flow from DMA (cfs) *Q_p =Item 2 * 0.9 * (Item 1 - Item 5)*							
7 Time of concentration adjustment factor for other DMA to site discharge point *Form 4.2-4 Item 12 DMA / Other DMA upstream of site discharge point (If ratio is greater than 1.0, then use maximum value of 1.0)*	DA 1	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
	DA 2	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
	DA 3	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*

8 Pre-developed Q_p at T_c for DMA A: n/a *Q_p = Item 6_{DMAA} + [Item 6_{DMAB} * (Item 1_{DMAA} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAA/2}$] + [Item 6_{DMAC} * (Item 1_{DMAA} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAA/3}$]*	**9** Pre-developed Q_p at T_c for DMA B: n/a *Q_p = Item 6_{DMAB} + [Item 6_{DMAA} * (Item 1_{DMAB} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAB/1}$] + [Item 6_{DMAC} * (Item 1_{DMAB} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAB/3}$]*	**10** Pre-developed Q_p at T_c for DMA C: n/a *Q_p = Item 6_{DMAC} + [Item 6_{DMAA} * (Item 1_{DMAC} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAC/1}$] + [Item 6_{DMAB} * (Item 1_{DMAC} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAC/2}$]*
10 Peak runoff from pre-developed condition confluence analysis (cfs): *Maximum of Item 8, 9, and 10 (including additional forms as needed)*		
11 Post-developed Q_p at T_c for DMA A: *Same as Item 8 for post-developed values*	**12** Post-developed Q_p at T_c for DMA B: n/a *Same as Item 9 for post-developed values*	**13** Post-developed Q_p at T_c for DMA C: n/a *Same as Item 10 for post-developed values*
14 Peak runoff from post-developed condition confluence analysis (cfs): *Maximum of Item 11, 12, and 13 (including additional forms as needed)*		
15 Peak runoff reduction needed to meet HCOC Requirement (cfs): *$Q_{p\text{-}HCOC}$ = (Item 14 * 0.95) – Item 10*		

4.3 Project Conformance Analysis

Complete the following forms for each project site DA to document that the proposed LID BMPs conform to the project DCV developed to meet performance criteria specified in the MS4 Permit (WQMP Template Section 4.2). For the LID DCV, the forms are ordered according to hierarchy of BMP selection as required by the MS4 Permit (see Section 5.3.1 in the TGD for WQMP). The forms compute the following for on-site LID BMP:

♣ Site Design and Hydrologic Source Controls (Form 4.3-2)

♣ Retention and Infiltration (Form 4.3-3)

♣ Harvested and Use (Form 4.3-4) or

♣ Biotreatment (Form 4.3-5).

At the end of each form, additional fields facilitate the determination of the extent of mitigation provided by the specific BMP category, allowing for use of the next category of BMP in the hierarchy, if necessary.

The first step in the analysis, using Section 5.3.2.1 of the TGD for WQMP, is to complete Forms 4.3-1 and 4.3-3) to determine if retention and infiltration BMPs are infeasible for the project. For each feasibility criterion in Form 4.3-1, if the answer is "Yes," provide all study findings that includes relevant calculations, maps, data sources, etc. used to make the determination of infeasibility.

Next, complete Forms 4.3-2 and 4.3-4 to determine the feasibility of applicable HSC and harvest and use BMPs, and, if their implementation is feasible, the extent of mitigation of the DCV.

If no site constraints exist that would limit the type of BMP to be implemented in a DA, evaluate the use of combinations of LID BMPs, including all applicable HSC BMPs to maximize on-site retention of the DCV. If no combination of BMP can mitigate the entire DCV, implement the single BMP type, or combination of BMP types, that maximizes on-site retention of the DCV within the minimum effective area.

If the combination of LID HSC, retention and infiltration, and harvest and use BMPs are unable to mitigate the entire DCV, then biotreatment BMPs may be implemented by the project proponent. If biotreatment BMPs are used, then they must be sized to provide sufficient capacity for effective treatment of the remainder of the volume-based performance criteria that cannot be achieved with LID BMPs (TGD for WQMP Section 5.4.4.2). Under no circumstances shall any portion of the DCV be released from the site without effective mitigation and/or treatment.

Form 4.3-1 Infiltration BMP Feasibility

Feasibility Criterion – Complete evaluation for each DA on the Project Site: DA1

[1] Would infiltration BMP pose significant risk for groundwater related concerns? Yes ☐ No ☒
Refer to Section 5.3.2.1 of the TGD for WQMP

If Yes, Provide basis: (attach) Note that the groundwater plume is upstream of drainage area. No risk anticipated.

[2] Would installation of infiltration BMP significantly increase the risk of geotechnical hazards? Yes ☐ No ☒
(Yes, if the answer to any of the following questions is yes, as established by a geotechnical expert):

- The location is less than 50 feet away from slopes steeper than 15 percent
- The location is less than eight feet from building foundations or an alternative setback.
- A study certified by a geotechnical professional or an available watershed study determines that stormwater infiltration would result in significantly increased risks of geotechnical hazards.

If Yes, Provide basis: (attach)

[3] Would infiltration of runoff on a Project site violate downstream water rights? Yes ☐ No ☒

If Yes, Provide basis: (attach)

[4] Is proposed infiltration facility located on hydrologic soil group (HSG) D soils or does the site geotechnical investigation indicate presence of soil characteristics, which support categorization as D soils? Yes ☐ No ☒

If Yes, Provide basis: (attach)

[5] Is the design infiltration rate, after accounting for safety factor of 2.0, below proposed facility less than 0.3 in/hr (accounting for soil amendments)? Yes ☐ No ☒

If Yes, Provide basis: (attach)

[6] Would on-site infiltration or reduction of runoff over pre-developed conditions be partially or fully inconsistent with watershed management strategies as defined in the WAP, or impair beneficial uses? Yes ☐ No ☒
See Section 3.5 of the TGD for WQMP and WAP

If Yes, Provide basis: (attach)

[7] Any answer from Item 1 through Item 3 is "Yes": Yes ☐ No ☒
If yes, infiltration of any volume is not feasible onsite. Proceed to Form 4.3-4, Harvest and Use BMP. If no, then proceed to Item 8 below.

[8] Any answer from Item 4 through Item 6 is "Yes": Yes ☐ No ☒
If yes, infiltration is permissible but is not required to be considered. Proceed to Form 4.3-2, Hydrologic Source Control BMP.
If no, then proceed to Item 9, below.

[9] All answers to Item 1 through Item 6 are "No":
Infiltration of the full DCV is potentially feasible, LID infiltration BMP must be designed to infiltrate the full DCV to the MEP.
Proceed to Form 4.3-2, Hydrologic Source Control BMP.

Form 4.3-1 Infiltration BMP Feasibility

Feasibility Criterion – Complete evaluation for each DA on the Project Site: DA2

[1] Would infiltration BMP pose significant risk for groundwater related concerns? Yes ☐ No ☒
Refer to Section 5.3.2.1 of the TGD for WQMP

If Yes, Provide basis: (attach) Note that the groundwater plume is upstream of drainage area. No risk anticipated.

[2] Would installation of infiltration BMP significantly increase the risk of geotechnical hazards? Yes ☐ No ☒
(Yes, if the answer to any of the following questions is yes, as established by a geotechnical expert):

- The location is less than 50 feet away from slopes steeper than 15 percent
- The location is less than eight feet from building foundations or an alternative setback.
- A study certified by a geotechnical professional or an available watershed study determines that stormwater infiltration would result in significantly increased risks of geotechnical hazards.

If Yes, Provide basis: (attach)

[3] Would infiltration of runoff on a Project site violate downstream water rights? Yes ☐ No ☒

If Yes, Provide basis: (attach)

[4] Is proposed infiltration facility located on hydrologic soil group (HSG) D soils or does the site geotechnical investigation indicate presence of soil characteristics, which support categorization as D soils? Yes ☐ No ☒

If Yes, Provide basis: (attach)

[5] Is the design infiltration rate, after accounting for safety factor of 2.0, below proposed facility less than 0.3 in/hr (accounting for soil amendments)? Yes ☐ No ☒

If Yes, Provide basis: (attach)

[6] Would on-site infiltration or reduction of runoff over pre-developed conditions be partially or fully inconsistent with watershed management strategies as defined in the WAP, or impair beneficial uses? Yes ☐ No ☒
See Section 3.5 of the TGD for WQMP and WAP

If Yes, Provide basis: (attach)

[7] Any answer from Item 1 through Item 3 is "Yes": Yes ☐ No ☒
If yes, infiltration of any volume is not feasible onsite. Proceed to Form 4.3-4, Harvest and Use BMP. If no, then proceed to Item 8 below.

[8] Any answer from Item 4 through Item 6 is "Yes": Yes ☐ No ☒
If yes, infiltration is permissible but is not required to be considered. Proceed to Form 4.3-2, Hydrologic Source Control BMP.
If no, then proceed to Item 9, below.

[9] All answers to Item 1 through Item 6 are "No":
Infiltration of the full DCV is potentially feasible, LID infiltration BMP must be designed to infiltrate the full DCV to the MEP.
Proceed to Form 4.3-2, Hydrologic Source Control BMP.

4.3.1 Site Design Hydrologic Source Control BMP

Section XI.E. of the Permit emphasizes the use of LID preventative measures; and the use of LID HSC BMPs reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable HSC shall be provided except where they are mutually exclusive with each other, or with other BMPs. Mutual exclusivity may result from overlapping BMP footprints such that either would be potentially feasible by itself, but both could not be implemented. Please note that while there are no numeric standards regarding the use of HSC, if a project cannot feasibly meet BMP sizing requirements or cannot fully address HCOCs, feasibility of all applicable HSC must be part of demonstrating that the BMP system has been designed to retain the maximum feasible portion of the DCV. Complete Form 4.3-2 to identify and calculate estimated retention volume from implementing site design HSC BMP. Refer to Section 5.4.1 in the TGD for more detailed guidance.

Form 4.3-2 Site Design Hydrologic Source Control BMPs

1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☒ *If yes, complete Items 2-5; If no, proceed to Item 6*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)			
3 Ratio of pervious area receiving runoff to impervious area			
4 Retention volume achieved from impervious area dispersion (ft^3) *V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff*			
5 Sum of retention volume achieved from impervious area dispersion (ft^3): 0 *$V_{retention}$ =Sum of Item 4 for all BMPs*			
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ *If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
7 Ponding surface area (ft^2)			
8 Ponding depth (ft)			
9 Surface area of amended soil/gravel (ft^2)			
10 Average depth of amended soil/gravel (ft)			
11 Average porosity of amended soil/gravel			
12 Retention volume achieved from on-lot infiltration (ft^3) *$V_{retention}$ = (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*			
13 Runoff volume retention from on-lot infiltration (ft^3): 0 *$V_{retention}$ =Sum of Item 12 for all BMPs*			

Form 4.3-2 cont. Site Design Hydrologic Source Control BMPs

14 Implementation of evapotranspiration BMP (green, brown, or blue roofs): Yes ☐ No ☒ *If yes, complete Items 15-20. If no, proceed to Item 21*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
15 Rooftop area planned for ET BMP (ft^2)			
16 Average wet season ET demand (in/day) *Use local values, typical ~ 0.1*			
17 Daily ET demand (ft^3/day) *Item 15 * (Item 16 / 12)*			
18 Drawdown time (hrs) *Copy Item 6 in Form 4.2-1*			
19 Retention Volume (ft^3) *$V_{retention}$ = Item 17 * (Item 18 / 24)*			
20 Runoff volume retention from evapotranspiration BMPs (ft^3): 0 *$V_{retention}$ =Sum of Item 19 for all BMPs*			
21 Implementation of Street Trees: Yes ☐ No ☒ *If yes, complete Items 22-25. If no, proceed to Item 26*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
22 Number of Street Trees			
23 Average canopy cover over impervious area (ft^2)			
24 Runoff volume retention from street trees (ft^3) *$V_{retention}$ = Item 22 * Item 23 * (0.05/12) assume runoff retention of 0.05 inches*			
25 Runoff volume retention from street tree BMPs (ft^3): 0 *$V_{retention}$ = Sum of Item 24 for all BMPs*			
26 Implementation of residential rain barrel/cisterns: Yes ☐ No ☒ *If yes, complete Items 27-29; If no, proceed to Item 30*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
27 Number of rain barrels/cisterns			
28 Runoff volume retention from rain barrels/cisterns (ft^3) *$V_{retention}$ = Item 27 * 3*			
29 Runoff volume retention from residential rain barrels/Cisterns (ft3): *$V_{retention}$ =Sum of Item 28 for all BMPs*			
30 Total Retention Volume from Site Design Hydrologic Source Control BMPs: 0 *Sum of Items 5, 13, 20, 25 and 29*			

4.3.2 Infiltration BMPs

Use Form 4.3-3 to compute on-site retention of runoff from proposed retention and infiltration BMPs. Volume retention estimates are sensitive to the percolation rate used, which determines the amount of runoff that can be infiltrated within the specified drawdown time. The infiltration safety factor reduces field measured percolation to account for potential inaccuracy associated with field measurements, declining BMP performance over time, and compaction during construction. Appendix D of the TGD for WQMP provides guidance on estimating an appropriate safety factor to use in Form 4.3-3. If site constraints limit the use of BMPs to a single type and implementation of retention and infiltration BMPs mitigate no more than 40% of the DCV, then they are considered infeasible and the Project Proponent may evaluate the effectiveness of BMPs lower in the LID hierarchy of use (Section 5.5.1 of the TGD for WQMP) If implementation of infiltrations BMPs is feasible as determined using Form 4.3-1, then LID infiltration BMPs shall be implemented to the MEP (section 4.1 of the TGD for WQMP).

Form 4.3-3 Infiltration LID BMP - including underground BMPs

1 Remaining LID DCV not met by site design HSC BMP (ft^3): *V_{unmet} = 56,126 ft^3 Form 4.2-1 Item 7 - Form 4.3-2 Item 30*

BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	DA 1 BMP Type Above ground infiltration basin		
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*	4.8		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	3.75		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	1.28		
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48		
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	4.0		
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	5.12		
8 Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	14,650		
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	0		
10 Amended soil porosity	0		
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	0		
12 Gravel porosity	0		
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3		
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	79,700		
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	0		

16 Total Retention Volume from LID Infiltration BMPs: 79,700 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 142% *Retention% = Item 16 / Form 4.2-1 Item 7*

18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes ☒ No ☐

If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.

Form 4.3-3 Infiltration LID BMP - including underground BMPs

1 Remaining LID DCV not met by site design HSC BMP (ft^3): *V_{unmet} = 27,439 ft^3 Form 4.2-1 Item 7 - Form 4.3-2 Item 30*			
BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	DA 2 BMP Type Above ground infiltration basin		
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*	4.8		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	3.75		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	1.28		
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48		
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	5.12		
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	4.0		
8 Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	6,550		
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	0		
10 Amended soil porosity	0		
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	0		
12 Gravel porosity	0		
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3		
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	35,600		
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	0		
16 Total Retention Volume from LID Infiltration BMPs: 35,600*(Sum of Items 14 and 15 for all infiltration BMP included in plan)*			
17 Fraction of DCV achieved with infiltration BMP: 130% *Retention% = Item 16 / Form 4.2-1 Item 7*			
18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes ☒ No ☐ *If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.*			

4.3.3 Harvest and Use BMP

Harvest and use BMP may be considered if the full LID DCV cannot be met by maximizing infiltration BMPs. Use Form 4.3-4 to compute on-site retention of runoff from proposed harvest and use BMPs.

Volume retention estimates for harvest and use BMPs are sensitive to the on-site demand for captured stormwater. Since irrigation water demand is low in the wet season, when most rainfall events occur in San Bernardino County, the volume of water that can be used within a specified drawdown period is relatively low. The bottom portion of Form 4.3-4 facilitates the necessary computations to show infeasibility if a minimum incremental benefit of 40 percent of the LID DCV would not be achievable with MEP implementation of on-site harvest and use of stormwater (Section 5.5.4 of the TGD for WQMP).

Form 4.3-4 Harvest and Use BMPs (All DAs)

1 Remaining LID DCV not met by site design HSC or infiltration BMP (ft^3): 0 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16*			
BMP Type(s) *Compute runoff volume retention from proposed harvest and use BMP (Select BMPs from Table 5-4 of the TGD for WQMP) - Use additional forms for more BMPs*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Describe cistern or runoff detention facility			
3 Storage volume for proposed detention type (ft^3) *Volume of cistern*			
4 Landscaped area planned for use of harvested stormwater (ft^2)			
5 Average wet season daily irrigation demand (in/day) Use local values, typical ~ 0.1 in/day			
6 Daily water demand (ft^3/day) *Item 4 * (Item 5 / 12)*			
7 Drawdown time (hrs) *Copy Item 6 from Form 4.2-1*			
8 Retention Volume (ft^3) *$V_{retention}$ = Minimum of (Item 3) or (Item 6 * (Item 7 / 24))*			
9 Total Retention Volume (ft^3) from Harvest and Use BMP *Sum of Item 8 for all harvest and use BMP included in plan*			
10 Is the full DCV retained with a combination of LID HSC, retention and infiltration, and harvest & use BMPs? Yes ☐ No ☐ *If yes, demonstrate conformance using Form 4.3-10. If no, then re-evaluate combinations of all LID BMP and optimize their implementation such that the maximum portion of the DCV is retained on-site (using a single BMP type or combination of BMP types). If the full DCV cannot be mitigated after this optimization process, proceed to Section 4.3.4.*			

4.3.4 Biotreatment BMP

Biotreatment BMPs may be considered if the full LID DCV cannot be met by maximizing retention and infiltration, and harvest and use BMPs. A key consideration when using biotreatment BMP is the effectiveness of the proposed BMP in addressing the pollutants of concern for the project (see Table 5-5 of the TGD for WQMP).

Use Form 4.3-5 to summarize the potential for volume based and/or flow based biotreatment options to biotreat the remaining unmet LID DCV w. Biotreatment computations are included as follows:

- Use Form 4.3-6 to compute biotreatment in small volume based biotreatment BMP (e.g. bioretention w/underdrains);
- Use Form 4.3-7 to compute biotreatment in large volume based biotreatment BMP (e.g. constructed wetlands);
- Use Form 4.3-8 to compute sizing criteria for flow-based biotreatment BMP (e.g. bioswales)

Form 4.3-5 Selection and Evaluation of Biotreatment BMP (All DAs)

1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft^3): 0 *Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9*	List pollutants of concern *Copy from Form 2.3-1.*	
2 Biotreatment BMP Selected *(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)*	Volume-based biotreatment *Use Forms 4.3-6 and 4.3-7 to compute treated volume*	Flow-based biotreatment *Use Form 4.3-8 to compute treated volume*
	☐ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft^3): *Form 4.3-6 Item 15 + Form 4.3-7 Item 13*	**4** Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): *Item 1 – Item 3*	**5** Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % *Item 4 / Item 1*
6 Flow-based biotreatment BMP capacity provided (cfs): *Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)*		
7 Metrics for MEP determination: • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ *If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.*		

Form 4.3-6 Volume Based Biotreatment (All DAs) – Bioretention and Planter Boxes with Underdrains

Biotreatment BMP Type *(Bioretention w/underdrain, planter box w/underdrain, other comparable BMP)*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
1 Pollutants addressed with BMP *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*			
2 Amended soil infiltration rate *Typical ~ 5.0*			
3 Amended soil infiltration safety factor *Typical ~ 2.0*			
4 Amended soil design percolation rate (in/hr) P_{design} *= Item 2 / Item 3*			
5 Ponded water drawdown time (hr) *Copy Item 6 from Form 4.2-1*			
6 Maximum ponding depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
7 Ponding Depth (ft) d_{BMP} *= Minimum of (1/12 * Item 4 * Item 5) or Item 6*			
8 Amended soil surface area (ft^2)			
9 Amended soil depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
10 Amended soil porosity, *n*			
11 Gravel depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
12 Gravel porosity, *n*			
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*			
14 Biotreated Volume (ft^3) $V_{biotreated}$ *= Item 8 * [(Item 7/2) + (Item 9 * Item 10) +(Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*			
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: *Sum of Item 14 for all volume-based BMPs included in this form*			

Form 4.3-7 Volume Based Biotreatment (All DAs) – Constructed Wetlands and Extended Detention

Biotreatment BMP Type *Constructed wetlands, extended wet detention, extended dry detention, or other comparable proprietary BMP. If BMP includes multiple modules (e.g. forebay and main basin), provide separate estimates for storage and pollutants treated in each module.*	DA DMA BMP Type		DA DMA BMP Type *(Use additional forms for more BMPs)*	
	Forebay	Basin	Forebay	Basin
1 Pollutants addressed with BMP forebay and basin *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*				
2 Bottom width (ft)				
3 Bottom length (ft)				
4 Bottom area (ft^2) A_{bottom} = *Item 2 * Item 3*				
5 Side slope (ft/ft)				
6 Depth of storage (ft)				
7 Water surface area (ft^2) $A_{surface}$ =*(Item 2 + (2 * Item 5 * Item 6)) * (Item 3 + (2 * Item 5 * Item 6))*				
8 Storage volume (ft^3) *For BMP with a forebay, ensure fraction of total storage is within ranges specified in BMP specific fact sheets, see Table 5-6 of the TGD for WQMP for reference to BMP design details* V =*Item 6 / 3 * [Item 4 + Item 7 + (Item 4 * Item 7)^0.5]*				
9 Drawdown Time (hrs) *Copy Item 6 from Form 2.1*				
10 Outflow rate (cfs) Q_{BMP} = *(Item $8_{forebay}$ + Item 8_{basin}) / (Item 9 * 3600)*				
11 Duration of design storm event (hrs)				
12 Biotreated Volume (ft^3) $V_{biotreated}$ = *(Item $8_{forebay}$ + Item 8_{basin}) +(Item 10 * Item 11 * 3600)*				
13 Total biotreated volume from constructed wetlands, extended dry detention, or extended wet detention : *(Sum of Item 12 for all BMP included in plan)*				

Form 4.3-8 Flow Based Biotreatment (All DAs)

Biotreatment BMP Type *Vegetated swale, vegetated filter strip, or other comparable proprietary BMP*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
1 Pollutants addressed with BMP *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in TGD Table 5-5*			
2 Flow depth for water quality treatment (ft) *BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
3 Bed slope (ft/ft) *BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
4 Manning's roughness coefficient			
5 Bottom width (ft) b_w *= (Form 4.3-5 Item 6 * Item 4) / (1.49 * Item 2^1.67 * Item 3^0.5)*			
6 Side Slope (ft/ft) *BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
7 Cross sectional area (ft^2) *A = (Item 5 * Item 2) + (Item 6 * Item 2^2)*			
8 Water quality flow velocity (ft/sec) *V = Form 4.3-5 Item 6 / Item 7*			
9 Hydraulic residence time (min) *Pollutant specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
10 Length of flow based BMP (ft) *L = Item 8 * Item 9 * 60*			
11 Water surface area at water quality flow depth (ft^2) SA_{top} *= (Item 5 + (2 * Item 2 * Item 6)) * Item 10*			

4.3.5 Conformance Summary

Complete Form 4.3-9 to demonstrate how on-site LID DCV is met with proposed site design hydrologic source control, infiltration, harvest and use, and/or biotreatment BMP. The bottom line of the form is used to describe the basis for infeasibility determination for on-site LID BMP to achieve full LID DCV, and provides methods for computing remaining volume to be addressed in an alternative compliance plan. If the project has more than one outlet, then complete additional versions of this form for each outlet.

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 1)

1 Total LID DCV for the Project DA-1 (ft^3): 56,126 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design hydrologic source control LID BMP (ft^3): 0 *Copy Item 30 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 79,700 *Copy Item 16 in Form 4.3-3*

4 On-site retention with LID harvest and use BMP (ft^3): 0 *Copy Item 9 in Form 4.3-4*

5 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 *Copy Item 3 in Form 4.3-5*

6 Flow capacity provided by flow based biotreatment BMP (cfs): 0 *Copy Item 6 in Form 4.3-5*

7 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☒
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible and biotreatment BMP provide biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☒
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

8 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes for Form 4.3-5 Item 7, Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} *= (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%*
- An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility: ☐
  Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 2)

1 Total LID DCV for the Project DA-2 (ft^3): 27,439 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design hydrologic source control LID BMP (ft^3): 0 *Copy Item 30 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 35,600 *Copy Item 16 in Form 4.3-3*

4 On-site retention with LID harvest and use BMP (ft^3): 0 *Copy Item 9 in Form 4.3-4*

5 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 *Copy Item 3 in Form 4.3-5*

6 Flow capacity provided by flow based biotreatment BMP (cfs): 0 *Copy Item 6 in Form 4.3-5*

7 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☒
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible and biotreatment BMP provide biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☒
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

8 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes for Form 4.3-5 Item 7, Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} *= (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%*
- An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility: ☐
  Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed

4.3.6 Hydromodification Control BMP

Use Form 4.3-10 to compute the remaining runoff volume retention, after LID BMP are implemented, needed to address HCOC, and the increase in time of concentration and decrease in peak runoff necessary to meet targets for protection of waterbodies with a potential HCOC. Describe hydromodification control BMP that address HCOC, which may include off-site BMP and/or in-stream controls. Section 5.6 of the TGD for WQMP provides additional details on selection and evaluation of hydromodification control BMP.

Form 4.3-10 Hydromodification Control BMPs (All DAs)

1 Volume reduction needed for HCOC performance criteria (ft^3): *n/a (no HCOC) (Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*	**2** On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft^3): *Sum of Form 4.3-9 Items 2, 3, and 4 Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving HCOC volume reduction*
3 Remaining volume for HCOC volume capture (ft^3): 0 *Item 1 – Item 2*	**4** Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft^3): 0 *Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)*

5 If Item 4 is less than Item 3, incorporate in-stream controls on downstream waterbody segment to prevent impacts due to hydromodification ☐ *Attach in-stream control BMP selection and evaluation to this WQMP*

6 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes ☐ No ☐

If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:

- Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site or off-site retention BMP ☐
  BMP upstream of a waterbody segment with a potential HCOC may be used to demonstrate increased time of concentration through hydrograph attenuation (if so, show that the hydraulic residence time provided in BMP for a 2-year storm event is equal or greater than the addition time of concentration requirement in Form 4.2-4 Item 15)
- Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities ☐
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐

7 Form 4.2-2 Item 12 less than or equal to 5%: Yes ☐ No ☐

If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:

- Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site or off-site retention BMPs ☐
  BMPs upstream of a waterbody segment with a potential HCOC may be used to demonstrate additional peak runoff reduction through hydrograph attenuation (if so, attach to this WQMP, a hydrograph analysis showing how the peak runoff would be reduced during a 2-yr storm event)
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐

4.4 Alternative Compliance Plan (if applicable)

Describe an alternative compliance plan (if applicable) for projects not fully able to infiltrate, harvest and use, or biotreat the DCV via on-site LID practices. A project proponent must develop an alternative compliance plan to address the remainder of the LID DCV. Depending on project type some projects may qualify for water quality credits that can be applied to reduce the DCV that must be treated prior to development of an alternative compliance plan (see Form 2.4-1, Water Quality Credits). Form 4.3-9 Item 8 includes instructions on how to apply water quality credits when computing the DCV that must be met through alternative compliance. Alternative compliance plans may include one or more of the following elements:

- On-site structural treatment control BMP - All treatment control BMP should be located as close to possible to the pollutant sources and should not be located within receiving waters;
- Off-site structural treatment control BMP - Pollutant removal should occur prior to discharge of runoff to receiving waters;
- Urban runoff fund or In-lieu program, if available

Depending upon the proposed alternative compliance plan, approval by the executive officer may or may not be required (see Section 6 of the TGD for WQMP).

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

All BMP included as part of the project WQMP are required to be maintained through regular scheduled inspection and maintenance (refer to Section 8, Post Construction BMP Requirements, in the TGD for WQMP). Fully complete Form 5-1 summarizing all BMP included in the WQMP. Attach additional forms as needed. The WQMP shall also include a detailed Operation and Maintenance Plan for all BMP and may require a Maintenance Agreement (consult the jurisdiction's LIP). If a Maintenance Agreement is required, it must also be attached to the WQMP.

The City of Redlands shall be responsible for the maintenance and long-term funding of BMP maintenance. BMPs shall be maintained throughout the year, and inspection and maintenance activities shall be documented as part of this WQMP.

The City shall retain operations, inspections and maintenance records for these BMPs, and be made available upon request. All records shall be maintained by the City for at least five years after the recorded inspection date.

Before the transfer of responsibilities to the City, the Owner shall be responsible for the maintenance of BMPs.

Form 5-1 BMP Inspection and Maintenance (use additional forms as necessary)

Non-Structural Source Control BMPs

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
N-1 - Education of Property Owners, Tenants and Occupants on Stormwater BMPs	HOA to send pamphlets to Tenants / Homeowners	Distribution of educational material from the County of San Bernardino stormwater website (https://sbcountystormwater.org/) to occupants. Annual updates of the educational pamphlets on annual basis.	Within two months of occupancy and yearly thereafter
N-2 Activity Restrictions	City for Public Right-Of-Way and Landscaping HOA for Tenants / Homeowners	The HOA and the City will prescribe restrictions to protect water quality, through a Covenant, Condition and Restriction (CC&R's) agreement, or other equally effective measure, for the property. Inspection/maintenance to be conducted during litter patrols or landscaping	Weekly or when observed.

		activities. Violations to be reported to the HOA and the City.	
N-3 Landscape Management BMPs	City	Scheduled by the City. Maintenance activities for landscape areas shall be consistent with County and manufacturer guidelines for fertilizer and pesticide use. Inspections of the health of the landscape, erosion detection, irrigation system checks for leaks and operability. Maintenance includes trimming, weeding , removing and replacing and dead and dying plants, debris removal, erosion repair, fixing irrigation system leaks, and vegetation planting and replacement. Stockpiled materials during maintenance activities shall be placed away from drain inlets and runoff conveyance devices. Wastes shall be properly disposed of or recycled. Maintenance for common areas and landscape parking islands is scheduled by the City	Weekly or as determined by City staff
N-4 BMP Maintenance	City	Scheduled by the City for cleaning of all (structural and non-structural) BMP facilities. This includes regularly checking drain inlets for debris build-up, infiltration basin for noxious weed growth, trash, or erosion. Infiltration Basin BMPs shall be regularly mowed and maintained. Maintenance of BMP's implemented at the project site shall be performed at the frequency prescribed in the final WQMP. Records of inspections and BMP maintenance shall be maintained by the City and documented in the final WQMP, and shall be available for review upon request.	Weekly or as determined by city staff
N-11 Litter/Debris Control Program	HOA/City	Litter patrol, violation inspections, reporting and other litter control activities shall be in conjunction with maintenance	Weekly

		activities to ensure good housekeeping of the project's common areas. Litter collection and removal shall be performed on a weekly basis.	
N-12 Employee Training	HOA/City	All employees, contractors and subcontractors of the City and/or the HOA shall receive training on the proper use and staging of landscaping and other materials with the potential to impact runoff and proper clean-up of spills and materials.	Monthly
N-14 Common Area Catch Basin Inspection	City	To be scheduled by the City as required by the TGD, at least 80% of the project's private drainage facilities shall be inspected annually, and cleaned/maintained monthly, with 100% of facilities inspected and maintained within a two-year period. Drainage facilities include catch basins (storm drain inlets), detention basins, retention basins, sediment basins, open drainage channels, and lift stations.	Once a month to clean debris and silt in the bottom of drainage facilities. Intensified around October 1st of each year prior to the "first flush" storm.
N-15 Vacuum Sweeping of Public Streets and Parking Lots	City	The project's streets shall be swept, at minimum, prior to the start of the traditional rainy season and as needed.	Annually as needed
Structural Source Control BMPs			
S-1 Provide storm drain system stenciling and signage (CASQA New Development BMP Handbook SD-13)	City	Storm drains stencils shall be inspected for legibility, at a minimum, once prior to the storm season, no later than October 1st each year. Those determined to be illegible will be re-stenciled as soon as possible. Storm Drain should be stenciled every other year.	Inspect for re-stenciling needs and re-stencil as necessary annually. Re-stencil every other year.
S-4 Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	City for Public Parks and Trails HOA for Private (SFR) Landscaping	In conjunction with routine landscaping maintenance activities, inspect irrigation for signs of leaks, overspray and repair or adjust accordingly. Adjust system cycle to accommodate seasonal fluctuations in water demand and temperatures. Ensure	Ongoing

(Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)		use of native or drought tolerant/non-invasive plant species to minimize water consumption.	
S-6 Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	City	Implement the design principles incorporated in this PWQMP including: avoiding disturbance of existing westerly channel, construction of infiltration basin.	Ongoing

Infiltration Basin

LID BMPs Infiltration Basin				
Routine Action	**Maintenance Indicator**	**Inspection Frequency**	**Maintenance Frequency**	**Maintenance Activity**
Trash and Debris	Trash and Debris present	Annually, before wet season starts	Annually	Remove and dispose of trash and debris
Sediment Management	Sediment depth exceeds 10% of the facility design or drain time exceed 96 hours.	Annually, before wet season starts	Estimated 10 – 75 years	Remove and properly dispose of sediment. Regrade if necessary.
General Maintenance Inspection	Inlet/outlet structures, side slopes or other features damaged, erosion, burrows, emergence of trees or woody vegetation, graffiti or vandalism, fence damage, etc.	Annually, before wet season starts	Annually and/or after heavy rain event	Corrective action before wet season. Consult engineers if immediate solution is not evident.
Sediment Management	Sediment depth exceeds 10% of the facility design or standing water for more than 72 hours	Annually, 72 hours after a target storm event	Estimated 10 – 75 years	Remove and properly dispose of sediment. Regrade if necessary.
Performance Inspection	Inspected 48 hours after any rainfall. There shall be no standing water after that time. Standing water is an indication the basin needs maintenance.	48 hours after any rainfall	Adjust as needed	Corrective action before wet season. Consult engineers if immediate solution is not evident.

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

Include a site plan and drainage plan sheet set containing the following minimum information:

- Project location
- Site boundary
- Land uses and land covers, as applicable
- Suitability/feasibility constraints
- Structural Source Control BMP locations
- Site Design Hydrologic Source Control BMP locations
- LID BMP details
- Drainage delineations and flow information
- Drainage connections

6.2 Electronic Data Submittal

Minimum requirements include submittal of PDF exhibits in addition to hard copies. Format must not require specialized software to open. If the local jurisdiction requires specialized electronic document formats (as described in their local Local Implementation Plan), this section will describe the contents (e.g., layering, nomenclature, geo-referencing, etc.) of these documents so that they may be interpreted efficiently and accurately.

6.3 Post Construction

Attach all O&M Plans and Maintenance Agreements for BMP to the WQMP.

6.4 Other Supporting Documentation

- BMP Educational Materials
- Activity Restriction – C, C&R's & Lease Agreements

Attachment A

Existing Conditions and WQMP Exhibits

LEGEND

OVERLAND FLOW

DRAINAGE AREA BOUNDARY

SUBAREA & ACREAGE (E-1 / XX.X)

NODE ELEVATION & NUMBER (XX) XX EG, Q_{10}= XX CFS, Q_{100}= XX CFS

IMPERVIOUS AREA = 1.3 AC
PERVIOUS AREA = 81.8 AC
TOTAL AREA = 83.1 AC

N

150 0 75 150 300
SCALE 1"= 150'

CITRUS VALLEY
EXISTING DRAINAGE EXHIBIT
REDLANDS, CA

PREPARED BY:
HUITT-ZOLLARS
Huitt-Zollars, Inc. Irvine
2603 Main Street, Suite 400
Irvine, California 92614
Phone (949) 988-5815 Fax (949) 988-5820

PREPARED FOR:
MLC Holdings, Inc.

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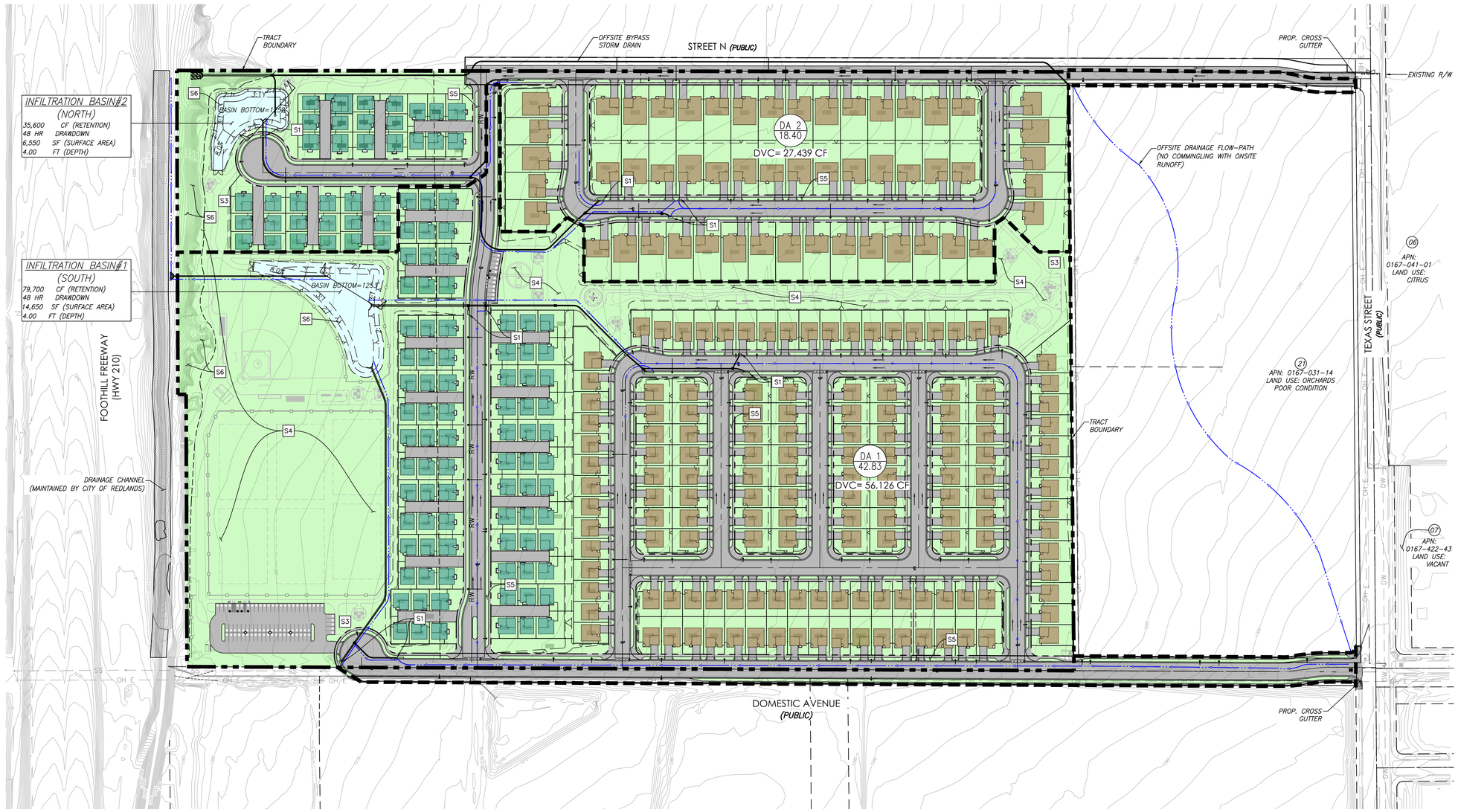
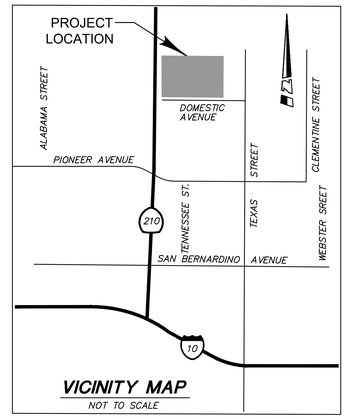




VICINITY MAP
NOT TO SCALE

LEGEND

- PERVIOUS AREA (LANDSCAPE, OPEN SPACE, PARK)
- PAVED AREA (DRIVEWAY, SIDEWALK, ALLEY)
- MEDIUM DENSITY (SFR)
- HIGH DENSITY (SFR)
- BASINS

LEGEND

SUBAREA DESTINATION – E-1
SUBAREA ACREAGE – XX.XX

- HYDROLOGIC SUBAREA BOUNDARY
- PROPOSED TRACT BOUNDARY
- DRAINAGE DELINEATIONS/FLOW-PATHS

STRUCTURAL SOURCE CONTROL BMPS

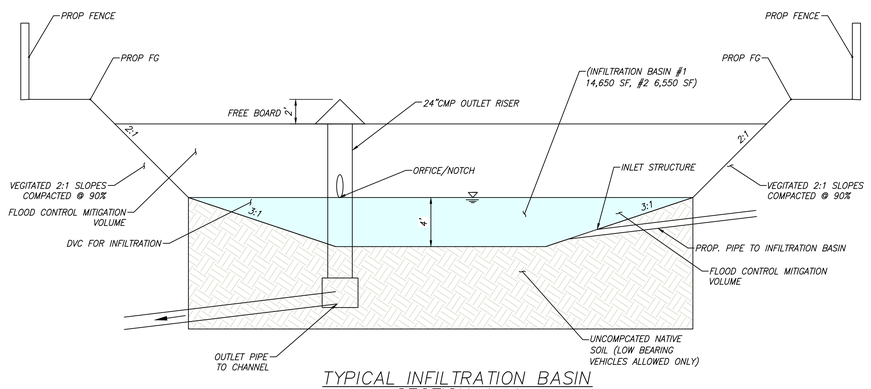
- S1 PROVIDE STORM DRAIN SYSTEM STENCELLING AND SIGNAGE
- S3 DESIGN AND CONSTRUCT TRASH AND WASTE STORAGE AREAS TO REDUCE POLLUTION INTRODUCTION
- S4 USE EFFECIENT IRRIGATION SYSTEMS AND LANDSCAPE DESIGN, WATER CONSERVATION, SMART CONTROLLERS, AND SOURCE CONTROL
- S5 FINISH GRADE OF LANDSCAPE AREAS AT A MINIMUM OF 1-2 INCHES BELOW TOP OF CURB, SIDEWALKS, OR PAVEMENT
- S6 PROTECT SLOPES AND CHANNELS AND PROVIDE ENERGY DISSIPATION

NOTES:

NO FEASIBILITY CONSTRAINTS TO INFILTRATION
NO RUNON TO SITE FROM OFFSITE AREAS

ACREAGE SUMMARY

IMPERVIOUS AREA = 37.8 AC APPROX.
PERVIOUS AREA = 47.6 AC APPROX.
TOTAL DRAINAGE AREA TO CHANNEL = 85.4 AC
OFFSITE AREA = 23.1 AC



TYPICAL INFILTRATION BASIN
SECTION A-A
SCALE: 1"=5'

PREPARED BY:
HUITT-ZOLLARS
Huitt-Zollars, Inc. Irvine
2603 Main Street, Suite 400
Irvine, California 92614
Phone (949) 988-5815 Fax (949) 988-5820

PREPARED FOR:
MLC Holdings, Inc.

N

100 0 50 100 200
SCALE 1"= 100'

CITRUS VALLEY
WQMP EXHIBIT
REDLANDS, CA

DATE: 07/02/2020

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Attachment B

LID BMP Sizing

	A	B	C	D	E
1	TTM20336 - Infiltration Basin 1 Calculations (DA1)			Notes	
3	Imperviousness ratio DA1 (South)	0.39			
5	C_{BMP} (DA1)	0.27			
6					
7	2-year 1 hour rainfall (in)	0.48		obtained from NOAA Redlands station	
8	P_6	0.71		using valley regression coefficient 1.4807	
10	P_0 (in) (DA1)	0.38			
11					
24					
25	**Safety factor Calculation- South Basin**				
26	Factor Category	Factor Description	Assigned weight	Factor Value + Notes	Product
27	Suitability Assessment	Soil assessment methods	0.25	2	0.5
28		Predominant soil texture	0.25	1	0.25
29		Site Soil Variability	0.25	1	0.25
30		Depth to GW/impervious layer	0.25	1	0.25
31		SUM S_A			**1.25**
32	Design	Tributary area size	0.25	3	0.75
33		Level of pretreatment/expected sediment loads	0.25	3	0.75
34		Redundancy	0.25	3	0.75
35		Compaction during construction	0.25	3	0.75
36		SUM S_B			**3**
37					
40	Safety Factor 1 (S_A x S_B)	3.75			
41					
42	Supporting Data:	3 Falling Head Percolation Tests performed 10-15 feet bgs in the vicinity of existing infiltration basin. Refer			
43		to Appendix D for Geotechnical Memorandum			
44					
45					
46	$C_{BMP} = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$				
47					
59	where: C_{BMP} = composite runoff coefficient; and,				
60	i = watershed imperviousness ratio.				
61					
62	$P_0 = a \cdot C_{BMP} \cdot P_6$				
63					
64	where: P_0 = Maximized Detention Volume, in inches				
65	a = 1.582 for 24 hour and a = 1.963 for 48 hour drawdown,				
66	C_{BMP} = composite runoff coefficient; and,				
67	P_6 = 6-hour Mean Storm Rainfall, in inches				
68	Drainage Management Area 1 (ac)	40.38			
69	V_0 capture target vol (ac-ft)	1.29			
70	V_0 capture target vol (cu.ft)	56125.74			
71					
72	Basin 1 Bottom Area (sq. ft)	13550.00	14905	Minimum SF < Proposed SF - OK	
73	Basin 1 height (ft)	5.50		Will be at least 6 ft. from bottom	
74	Total Area				
75	Infiltration rate (in/hr)	1.28		Lowest of three 4.8,6.8,5.4 /safety factor 2	
76	Volumetric infiltration rate (cu.Ft/hr)	1445.33			
77					
78	Drawdown time (hrs)	38.83		Less than 48 hrs? OK	

TECHNICAL GUIDANCE DOCUMENT APPENDICES

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25		
		Predominant soil texture	0.25		
		Site soil variability	0.25		
		Depth to groundwater / impervious layer	0.25		
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			
B	Design	Tributary area size	0.25		
		Level of pretreatment/ expected sediment loads	0.25		
		Redundancy	0.25		
		Compaction during construction	0.25		
		Design Safety Factor, $S_B = \Sigma p$			
Combined Safety Factor, $S_{TOT} = S_A \times S_B$					
Measured Infiltration Rate, inch/hr, K_M (corrected for test-specific bias)					
Design Infiltration Rate, in/hr, $K_{DESIGN} = S_{TOT} \times K_M$					

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

$V_0 = (P_0 \cdot A) / 12$

where: V_0 = Target Capture Volume, in acre-feet

P_0 = Maximized Detention Volume, in inches; and,

A = BMP Drainage Area, in acres

	A	B	C	D	E
1	TTM20336 - Infiltration Basin 2 Calculations (DA2)			Notes	
2	Imperviousness ratio DA2 (North)	0.43			
4	C_{BMP} (DA2)	0.30			
6					
7	2-year 1 hour rainfall (in)	0.48		obtained from NOAA Redlands station	
8	P_6	0.71		using valley regression coefficient 1.4807	
9	P_0 (in) (DA2)	0.41		using a = 1.963 for 48 hour drawdown	
11					
12	**Safety factor Calculation- North Basin**				
13	Factor Category	Factor Description	Assigned weight	Factor Value + Notes	Product
14	Suitability Assessment	Soil assessment methods	0.25	2	0.5
15		Predominant soil texture	0.25	1	0.25
16		Site Soil Variability	0.25	1	0.25
17		Depth to GW/impervious layer	0.25	1	0.25
18				SUM S_A	**1.25**
19	Design	Tributary area size	0.25	2	0.5
20		Level of pretreatment/expected sediment loads	0.25	3	0.75
21		Redundancy	0.25	3	0.75
22		Compaction during construction	0.25	3	0.75
23				SUM S_B	**2.75**
24					
39	Safety Factor 2 (S_A x S_B)	3.44			
41					
42	Supporting Data:	3 Falling Head Percolation Tests performed 10-15 feet bgs in the vicinity of existing infiltration basin. Refer			
43		to Appendix D for Geotechnical Memorandum			
44					
45					
46		$C_{BMP} = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$			
47					
48	where:	C_{BMP} = composite runoff coefficient; and,			
49		i = watershed imperviousness ratio.			
50					
51		$P_0 = a \cdot C_{BMP} \cdot P_6$			
52	where:	P_0 = Maximized Detention Volume, in inches			
53		a = 1.582 for 24 hour and a = 1.963 for 48 hour drawdown,			
54		C_{BMP} = composite runoff coefficient; and,			
55		P_6 = 6-hour Mean Storm Rainfall, in inches			
56					
57					
61					
62	Drainage Management Area 2 (ac)	18.29			
63	V_0 capture target vol (ac-ft)	0.63			
64	V_0 capture target vol (cu.ft)	27438.97			
65					
66	Basin 2 Bottom Area (sq. ft)	6700.00	7370	Minimum SF < Proposed SF - OK	
67	Basin 2 height (ft)	4.50			
68	Total Area				
69	Infiltration rate (in/hr)	1.40		Lowest of three 4.8,6.8,5.4 / safety factor 1	
70	Volumetric infiltration rate (cu.Ft/hr)	779.64			
71					
72	Drawdown time (hrs)	35.19		Less than 48 hrs? OK	

TECHNICAL GUIDANCE DOCUMENT APPENDICES

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25		
		Predominant soil texture	0.25		
		Site soil variability	0.25		
		Depth to groundwater / impervious layer	0.25		
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			
B	Design	Tributary area size	0.25		
		Level of pretreatment/ expected sediment loads	0.25		
		Redundancy	0.25		
		Compaction during construction	0.25		
		Design Safety Factor, $S_B = \Sigma p$			
Combined Safety Factor, $S_{TOT} = S_A \times S_B$					
Measured Infiltration Rate, inch/hr, K_M (corrected for test-specific bias)					
Design Infiltration Rate, in/hr, $K_{DESIGN} = S_{TOT} \times K_M$					

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

$V_0 = (P_0 \cdot A) / 12$

where: V_0 = Target Capture Volume, in acre-feet

P_0 = Maximized Detention Volume, in inches; and,

A = BMP Drainage Area, in acres

Attachment C

Referenced Materials

www.nws.noaa.gov

NOAA's National Weather Service
Hydrometeorological Design Studies Center
Precipitation Frequency Data Server (PFDS)

General Information
Homepage
Progress Reports
FAQ
Glossary

Precipitation Frequency
Data Server
GIS Grids
Maps
Time Series
Temporals
Documents

Probable Maximum Precipitation
Documents

Miscellaneous
Publications
Storm Analysis
Record Precipitation

Contact Us
Inquiries

NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES: CA

Data description

Data type: Precipitation depth **Units:** English **Time series type:** Partial duration

Select location

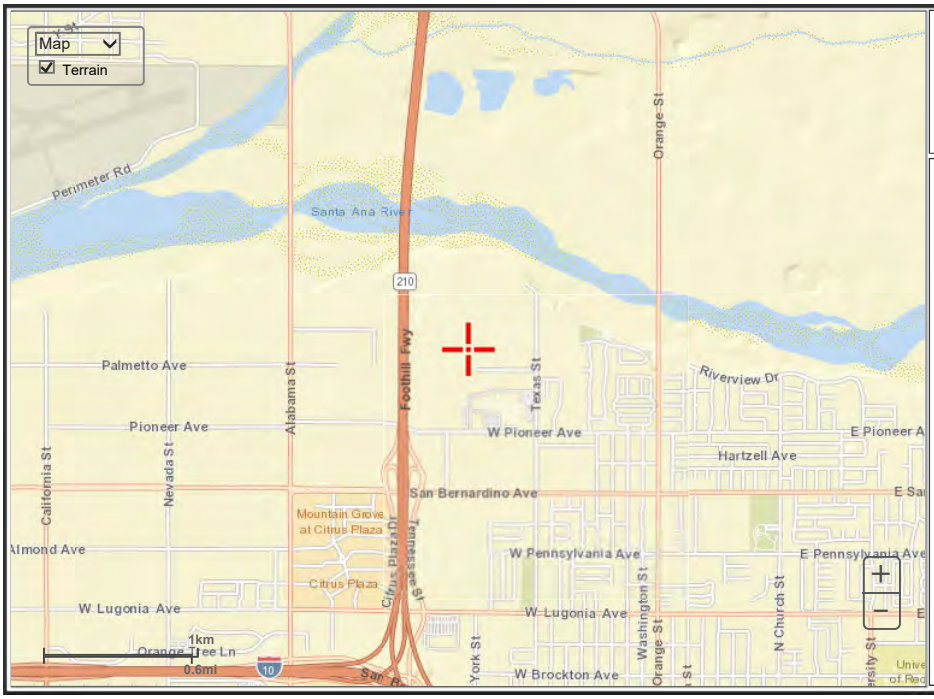
1) Manually:

a) By location (decimal degrees, use "-" for S and W): Latitude: Longitude: Submit

b) By station (list of CA stations): REDLANDS (04-7306)

c) By address Search

2) Use map (if ESRI interactive map is not loading, try adding the host: **https://js.arcgis.com/** to the firewall, or contact us at hdsc.questions@noaa.gov):



a) Select location
Move crosshair or double click

b) Click on station icon
Show stations on map

Location information:
Name: Redlands, California, USA*
Station name: REDLANDS
Site ID: 04-7306
Latitude: 34.0857°
Longitude: -117.1959°
Elevation: 1318 ft

* Source: ESRI Maps
** Source: USGS

POINT PRECIPITATION FREQUENCY (PF) ESTIMATES

WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION
NOAA Atlas 14, Volume 6, Version 2

PF tabular PF graphical Supplementary information Print page

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years) 1	2	5	10	25	50	100	200	500	1000
5-min	**0.099** (0.082-0.120)	**0.128** (0.106-0.156)	**0.167** (0.139-0.204)	**0.200** (0.164-0.246)	**0.246** (0.195-0.313)	**0.282** (0.219-0.367)	**0.320** (0.242-0.426)	**0.360** (0.265-0.493)	**0.415** (0.293-0.594)	**0.460** (0.313-0.682)
10-min	**0.141** (0.118-0.172)	**0.183** (0.152-0.223)	**0.240** (0.199-0.292)	**0.287** (0.236-0.353)	**0.352** (0.280-0.448)	**0.404** (0.314-0.525)	**0.458** (0.347-0.611)	**0.515** (0.380-0.707)	**0.595** (0.420-0.852)	**0.659** (0.449-0.977)
15-min	**0.171** (0.142-0.208)	**0.222** (0.184-0.270)	**0.290** (0.240-0.353)	**0.347** (0.285-0.426)	**0.426** (0.338-0.542)	**0.489** (0.380-0.635)	**0.554** (0.420-0.739)	**0.623** (0.459-0.855)	**0.720** (0.508-1.03)	**0.797** (0.543-1.18)
30-min	**0.255** (0.212-0.309)	**0.330** (0.274-0.401)	**0.432** (0.358-0.526)	**0.516** (0.424-0.635)	**0.635** (0.504-0.807)	**0.728** (0.566-0.946)	**0.826** (0.626-1.10)	**0.928** (0.684-1.27)	**1.07** (0.757-1.53)	**1.19** (0.809-1.76)
60-min	**0.370** (0.308-0.449)	**0.480** (0.399-0.583)	**0.627** (0.520-0.765)	**0.750** (0.616-0.922)	**0.922** (0.732-1.17)	**1.06** (0.822-1.38)	**1.20** (0.909-1.60)	**1.35** (0.993-1.85)	**1.56** (1.10-2.23)	**1.72** (1.18-2.56)
2-hr	**0.528** (0.439-0.641)	**0.677** (0.563-0.823)	**0.877** (0.726-1.07)	**1.04** (0.856-1.28)	**1.27** (1.01-1.61)	**1.45** (1.13-1.88)	**1.63** (1.24-2.17)	**1.82** (1.34-2.50)	**2.09** (1.47-2.99)	**2.30** (1.56-3.40)
3-hr	**0.650** (0.541-0.789)	**0.831** (0.690-1.01)	**1.07** (0.887-1.31)	**1.27** (1.04-1.56)	**1.54** (1.22-1.96)	**1.75** (1.36-2.28)	**1.97** (1.49-2.63)	**2.20** (1.62-3.01)	**2.51** (1.77-3.59)	**2.75** (1.87-4.08)
6-hr	**0.910** (0.757-1.11)	**1.16** (0.965-1.41)	**1.49** (1.24-1.82)	**1.76** (1.45-2.17)	**2.13** (1.69-2.71)	**2.42** (1.88-3.14)	**2.71** (2.06-3.61)	**3.01** (2.22-4.13)	**3.43** (2.42-4.90)	**3.75** (2.55-5.55)
12-hr	**1.21**	**1.56**	**2.00**	**2.37**	**2.86**	**3.24**	**3.63**	**4.02**	**4.56**	**4.97**

	(1.01-1.47)	(1.29-1.89)	(1.66-2.44)	(1.95-2.91)	(2.27-3.64)	(2.52-4.21)	(2.75-4.83)	(2.96-5.52)	(3.22-6.52)	(3.39-7.37)
24-hr	**1.63** (1.44-1.87)	**2.11** (1.86-2.43)	**2.73** (2.41-3.16)	**3.23** (2.83-3.77)	**3.92** (3.32-4.72)	**4.44** (3.68-5.46)	**4.97** (4.02-6.26)	**5.51** (4.34-7.13)	**6.24** (4.72-8.41)	**6.80** (4.98-9.49)
2-day	**2.01** (1.78-2.31)	**2.63** (2.33-3.04)	**3.46** (3.05-4.00)	**4.13** (3.62-4.82)	**5.05** (4.28-6.08)	**5.76** (4.78-7.08)	**6.48** (5.25-8.16)	**7.22** (5.69-9.35)	**8.23** (6.23-11.1)	**9.02** (6.60-12.6)
3-day	**2.17** (1.92-2.50)	**2.89** (2.55-3.33)	**3.84** (3.39-4.44)	**4.63** (4.05-5.39)	**5.71** (4.84-6.88)	**6.56** (5.44-8.06)	**7.43** (6.02-9.36)	**8.34** (6.57-10.8)	**9.58** (7.25-12.9)	**10.6** (7.73-14.7)
4-day	**2.34** (2.07-2.70)	**3.14** (2.77-3.62)	**4.20** (3.71-4.86)	**5.09** (4.45-5.94)	**6.32** (5.35-7.61)	**7.29** (6.05-8.96)	**8.29** (6.71-10.4)	**9.34** (7.36-12.1)	**10.8** (8.16-14.5)	**11.9** (8.74-16.7)
7-day	**2.70** (2.39-3.11)	**3.66** (3.23-4.22)	**4.93** (4.35-5.71)	**6.00** (5.25-7.00)	**7.49** (6.34-9.02)	**8.65** (7.18-10.6)	**9.87** (7.99-12.4)	**11.1** (8.78-14.4)	**12.9** (9.77-17.4)	**14.3** (10.5-20.0)
10-day	**2.92** (2.59-3.37)	**3.98** (3.52-4.59)	**5.40** (4.76-6.25)	**6.58** (5.76-7.68)	**8.24** (6.98-9.93)	**9.54** (7.92-11.7)	**10.9** (8.83-13.7)	**12.3** (9.71-16.0)	**14.3** (10.8-19.3)	**15.9** (11.6-22.1)
20-day	**3.61** (3.20-4.16)	**4.96** (4.38-5.72)	**6.78** (5.98-7.84)	**8.31** (7.27-9.69)	**10.5** (8.86-12.6)	**12.2** (10.1-14.9)	**13.9** (11.3-17.5)	**15.8** (12.5-20.5)	**18.4** (13.9-24.8)	**20.5** (15.0-28.6)
30-day	**4.25** (3.76-4.89)	**5.84** (5.17-6.74)	**8.01** (7.07-9.27)	**9.84** (8.61-11.5)	**12.4** (10.5-14.9)	**14.4** (12.0-17.8)	**16.6** (13.4-20.9)	**18.8** (14.8-24.4)	**22.0** (16.6-29.7)	**24.5** (17.9-34.2)
45-day	**5.09** (4.50-5.86)	**6.97** (6.17-8.05)	**9.54** (8.42-11.0)	**11.7** (10.2-13.7)	**14.8** (12.5-17.8)	**17.2** (14.3-21.2)	**19.8** (16.0-24.9)	**22.5** (17.7-29.1)	**26.3** (19.9-35.5)	**29.4** (21.5-40.9)
60-day	**5.96** (5.27-6.86)	**8.11** (7.18-9.36)	**11.1** (9.75-12.8)	**13.5** (11.9-15.8)	**17.1** (14.4-20.5)	**19.9** (16.5-24.4)	**22.8** (18.5-28.7)	**25.9** (20.4-33.6)	**30.3** (23.0-40.9)	**33.9** (24.8-47.2)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Estimates from the table in CSV format: Precipitation frequency estimates Submit

Main Link Categories:
Home | OWP

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Water Prediction (OWP)
1325 East West Highway
Silver Spring, MD 20910
Page Author: HDSC webmaster
Page last modified: April 21, 2017

WQMP Project Report

County of San Bernardino Stormwater Program

Santa Ana River Watershed Geodatabase

Sunday, June 28, 2020

Note: The information provided in this report and on the Stormwater Geodatabase for the County of San Bernardino Stormwater Program is intended to provide basic guidance in the preparation of the applicant's Water Quality Management Plan (WQMP) and should not be relied upon without independent verification.

Project Site Parcel Number(s):	016703103, 016703106, 016703105, 016703116, 016703102, 016703107, 016703104
Project Site Acreage:	58.004
HCOC Exempt Area:	Yes. Verify that the project is completely with the HCOC exemption area.
Closest Receiving Waters: (Applicant to verify based on local drainage facilities and topography.)	**System Number** - 101 **Facility Name** - Santa Ana River **Owner** - SBCFCD
Closest channel segment's susceptibility to Hydromodification:	EHM
Highest downstream hydromodification susceptibility:	High
Is this drainage segment subject to TMDLs?	No
Are there downstream drainage segments subject to TMDLs?	No
Is this drainage segment a 303d listed stream?	No
Are there 303d listed streams downstream?	Yes
Are there unlined downstream waterbodies?	No
Project Site Onsite Soil Group(s):	B
Environmentally Sensitive Areas within 200':	None
Groundwater Depth (FT):	-198
Parcels with potential septic tanks within 1000':	No
Known Groundwater Contamination Plumes within 1000':	Yes
Studies and Reports Related to Project Site:	CSDP No. 7 Storm Drain Systems CSDP No. 7 Storm Drain Systems CSDP No. 7 Storm Drain Systems CSDP No. 7 Storm Drain Hydraulic Design Data CSDP 4 CALC SHEET FOR HYDRO CSDP 4 Hydrological Design Criteria SBVMWD High Groundwater / Pressure Zone Area

Attachment D

Geotechnical Reports

February 10, 2020
J.N. 18-345

MLC HOLDINGS, INC.
5 Peters Canyon Road, Suite 310
Irvine, California 92606

Attention: Mr. Steven Cook

Subject: **Preliminary Infiltration Test Results, *Citrus Valley Project*, North of West Domestic Avenue and West of Texas Street, City of Redlands, San Bernardino County, California**

Dear Mr. Cook:

In accordance with your request, **Petra Geosciences, Inc. (Petra)** has completed preliminary field infiltration rate testing within the two proposed WQMP basins (Lots A and B), located in the Citrus Valley project site in the city of Redlands, California. Our preliminary percolation testing was performed to evaluate infiltration rates for preliminary design of proposed storm water retention basins in the noted planning areas, see Figure 1. This report presents the results of the falling-head percolation tests performed at three locations within the subject site to evaluate the infiltration rate of native soils in the zone approximately 5 feet below the bottom of the proposed basin floors.

The borings for the percolation tests were drilled with a hollow-stem auger drill rig to depths ranging from approximately 10 feet to 15 feet below the ground surface, which corresponds to approximately 5 feet below the anticipated floor elevation of potential retention basins. Natural alluvial soils were encountered in the test borings, generally consisting of medium dense fine- to medium-grained silty sands and sandy silt. Laboratory sieve analysis tests of soils sampled from the bottom of each test boring are included in Appendix B. The percolation tests were conducted in the bottom 5± feet of the boreholes.

The falling-head percolation test data was utilized in determining the test infiltration rate, I_t, expressed in units of inches/hour, utilizing the Porchet Method (RCFCWCD, 2011). Field testing was conducted in a perforated-cased borehole (with pea gravel surrounding the pipe) at 10-minute intervals for a period of approximately 2 hours. Test data are attached in Appendix A. The infiltration rate, I_t, was calculated by determining the volumetric water flow through the wetted borehole surface area, expressed in terms of inches per hour. Un-factored test results are summarized in the following table.

Infiltration Test Results

Test No.	Area Test Location	Approximate Test Zone (ft below natural grade)	Geologic Unit* / Soil Description	Infiltration Test Rate, I_t (in/hr)
P-1	Lot B	10 to 15	Silty SAND (SM)	6.8
P-2	Lot A Basin - east	10 to 15	Sandy SILT (ML)	4.8
P-3	Lot A Basin - west	5 to 10	Silty SAND (SM)	5.4

The test data indicate the subsurface native alluvial soils between 5 to 15 feet below grades exhibit a fairly consistent permeability at the three test locations with infiltration rates indicating moderate permeability. Although none of the tests indicated localized impermeability, variability is possible at other locations/depths within the site due to changes in both the material density and gradation.

This opportunity to be of service is sincerely appreciated. If you have any questions, please contact this office.

Respectfully submitted,

PETRA GEOSCIENCES, INC.

2/10/2020

Grayson R. Walker
Principal Engineer
GE 871

REGISTERED PROFESSIONAL ENGINEER
GRAYSON R. WALKER
GE 871
GEOTECHNICAL
STATE OF CALIFORNIA

DJ/GRW/lv

Attachments: Figure 1 – Percolation Test Location Map
Appendix A – Percolation Test Data Sheets
Appendix B – Sieve Analysis Tests

Distribution: (1) Addressee
(1) Mr. Remi Candaele, Huitt-Zollars, Inc

W:\2014-2019\2018\300\18-345 MLC Holdings (46 acres, Citris Valley, Redlands)\Reports\18-345 110 Preliminary Infiltration Testing.docx

Reference: Huitt-Zoliars, Inc., Conceptual Site Plan dated 1/24/20

PETRA GEOSCIENCES, INC.
40880 County Center Drive, Suite M
Temecula, California 92591
Phone: (951) 600-9271
COSTA MESA TEMECULA VALENCIA PALM DESERT CORONA

Percolcatoin Test Location Map

Citrus Valley Project
City of Redlands, California

PETRA GEOSCIENCES INC.

DATE: February 2020
J.N.: 18-345

Figure 1

APPENDIX A

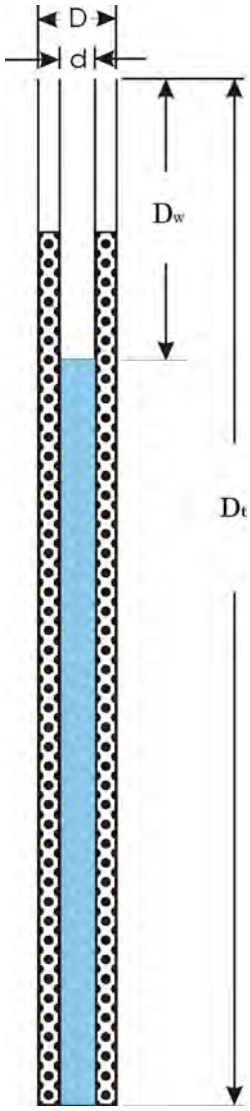
PERCOLATION TEST DATA SHEETS

Test Number: P-1

Deep Percolation Test Method

Total Depth of Boring, D_t (ft): 15
Diameter of Hole, D (in): 8
Diameter of Pipe, d (in): 2
Agg. Correction (% Voids): 42
Pre-soak depth (ft): 45

Time Interval (min)	Depth to Water Surface D_w (ft)		Change in Head (in)	Perc. Rate (min/in)	Perc. Rate (gal/day/ft^2)
	1st Reading	2nd Reading			
30	10.08	14.25	50.04	0.60	37.94
30	10.08	14.17	49.08	0.61	36.72
10	10.08	13.25	38.04	0.26	74.17
10	10.08	13.17	37.08	0.27	71.48
10	10.08	13.08	36.00	0.28	68.53
10	10.08	13.08	36.00	0.28	68.53
10	10.08	13.00	35.04	0.29	65.97
10	10.83	12.75	23.04	0.43	46.59
			0.00	#DIV/0!	#DIV/0!
			0.00	#DIV/0!	#DIV/0!
			0.00	#DIV/0!	#DIV/0!
			0.00	#DIV/0!	#DIV/0!



Percolation Rate: **0.43** **min/in**
46.59 **gal/day/ft^2**

Infiltration Rate: **6.82** **in/hr***
(Porchet Method)

where Infiltration Rate, $I_t = \Delta H\ (60r) / \Delta t\ (r + 2H_{avg})$

$r = D / 2$
$H_o = D_t - D_o$
$H_f = D_t - D_f$
$\Delta H = \Delta D = H_o - H_f$
$H_{avg} = (H_o + H_f) / 2$

*Raw Number, Does Not Include a Factor of Safety

Soil Description: (see Exploration Log)
fine SAND w/ Silt

Testing by: L.Holmes 2/05/2020

Reference: RCFCWCD, Design Handbook for LIDBMP, dated September, 2011

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COSTA MESA TEMECULA VALENCIA PALM DESERT CORONA

PERCOLATION TEST SUMMARY

Citrus Valley Project
Redlands, California

PETRA GEOSCIENCES INC.
February 2020
J.N.: 18-345

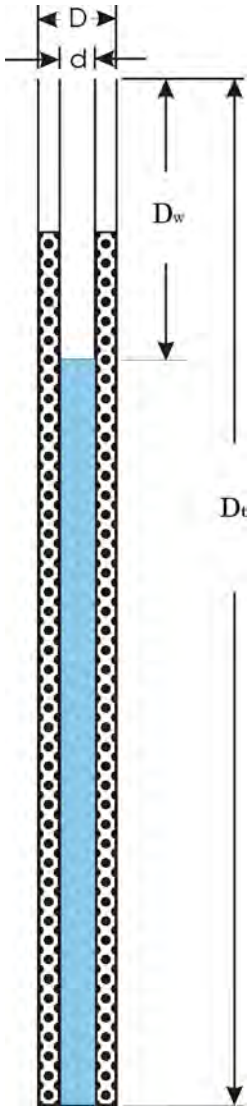
Figure 1

Test Number: P-2

Deep Percolation Test Method

Total Depth of Boring, D_t (ft): 15
Diameter of Hole, D (in): 8
Diameter of Pipe, d (in): 2
Agg. Correction (% Voids): 42
Pre-soak depth (ft): 45

Time Interval (min)	Depth to Water Surface D_w (ft)		Change in Head (in)	Perc. Rate (min/in)	Perc. Rate (gal/day/ft^2)
	1st Reading	2nd Reading			
30	9.70	14.40	56.40	0.53	41.18
23	9.50	13.70	50.40	0.46	41.95
10	9.70	11.80	25.20	0.40	38.96
10	9.70	11.60	22.80	0.44	34.47
10	9.70	11.60	22.80	0.44	34.47
10	9.95	11.70	21.00	0.48	33.02
10	9.60	11.40	21.60	0.46	31.60
10	9.95	11.70	21.00	0.48	33.02
			0.00	#DIV/0!	#DIV/0!
			0.00	#DIV/0!	#DIV/0!
			0.00	#DIV/0!	#DIV/0!
			0.00	#DIV/0!	#DIV/0!



Percolation Rate: **0.48** **min/in**

33.02 **gal/day/ft^2**

Infiltration Rate: **4.84** **in/hr***
(Porchet Method)

where Infiltration Rate, $I_t = \Delta H\ (60r) / \Delta t\ (r + 2H_{avg})$

$r = D / 2$

$H_o = D_t - D_o$

$H_f = D_t - D_f$

$\Delta H = \Delta D = H_o - H_f$

$H_{avg} = (H_o + H_f) / 2$

*Raw Number, Does Not Include a Factor of Safety

Soil Description: (see Exploration Log)
Silty SAND

Testing by: L.Holmes 2/05/2020

Reference: RCFCWCD, Design Handbook for LIDBMP, dated September, 2011

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PERCOLATION TEST SUMMARY

Citrus Valley Project
Redlands, California

PETRA GEOSCIENCES INC.
February 2020
J.N.: 18-345

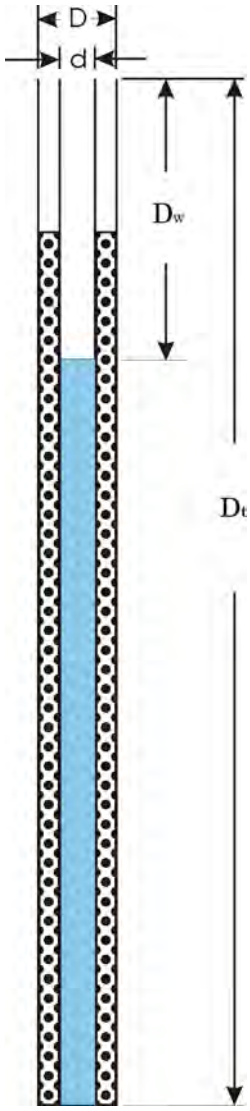
Figure 2

Test Number: P-3

Deep Percolation Test Method

Total Depth of Boring, D_t (ft): 10
Diameter of Hole, D (in): 8
Diameter of Pipe, d (in): 2
Agg. Correction (% Voids): 42
Pre-soak depth (ft): 45

Time Interval (min)	Depth to Water Surface D_w (ft)		Change in Head (in)	Perc. Rate (min/in)	Perc. Rate (gal/day/ft^2)
	1st Reading	2nd Reading			
28	4.50	9.30	57.60	0.49	43.00
7	4.80	7.90	37.20	0.19	95.07
10	4.95	7.30	28.20	0.35	47.64
10	4.85	7.05	26.40	0.38	42.75
10	4.85	6.95	25.20	0.40	40.33
10	4.80	6.80	24.00	0.42	37.53
10	4.90	6.90	24.00	0.42	38.40
10	4.85	6.80	23.40	0.43	36.80
			0.00	#DIV/0!	#DIV/0!
			0.00	#DIV/0!	#DIV/0!
			0.00	#DIV/0!	#DIV/0!
			0.00	#DIV/0!	#DIV/0!



Percolation Rate: **0.43** **min/in**
36.80 **gal/day/ft^2**

Infiltration Rate: **5.39** **in/hr***
(Porchet Method)

where Infiltration Rate, $I_t = \Delta H\ (60r) / \Delta t\ (r + 2H_{avg})$

$r = D / 2$

$H_o = D_t - D_o$

$H_f = D_t - D_f$

$\Delta H = \Delta D = H_o - H_f$

$H_{avg} = (H_o + H_f) / 2$

*Raw Number, Does Not Include a Factor of Safety

Soil Description: (see Exploration Log)
Silty SAND

Testing by: L.Holmes 2/05/2020

Reference: RCFCWCD, Design Handbook for LIDBMP, dated September, 2011

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PERCOLATION TEST SUMMARY

Citrus Valley Project
Redlands, California

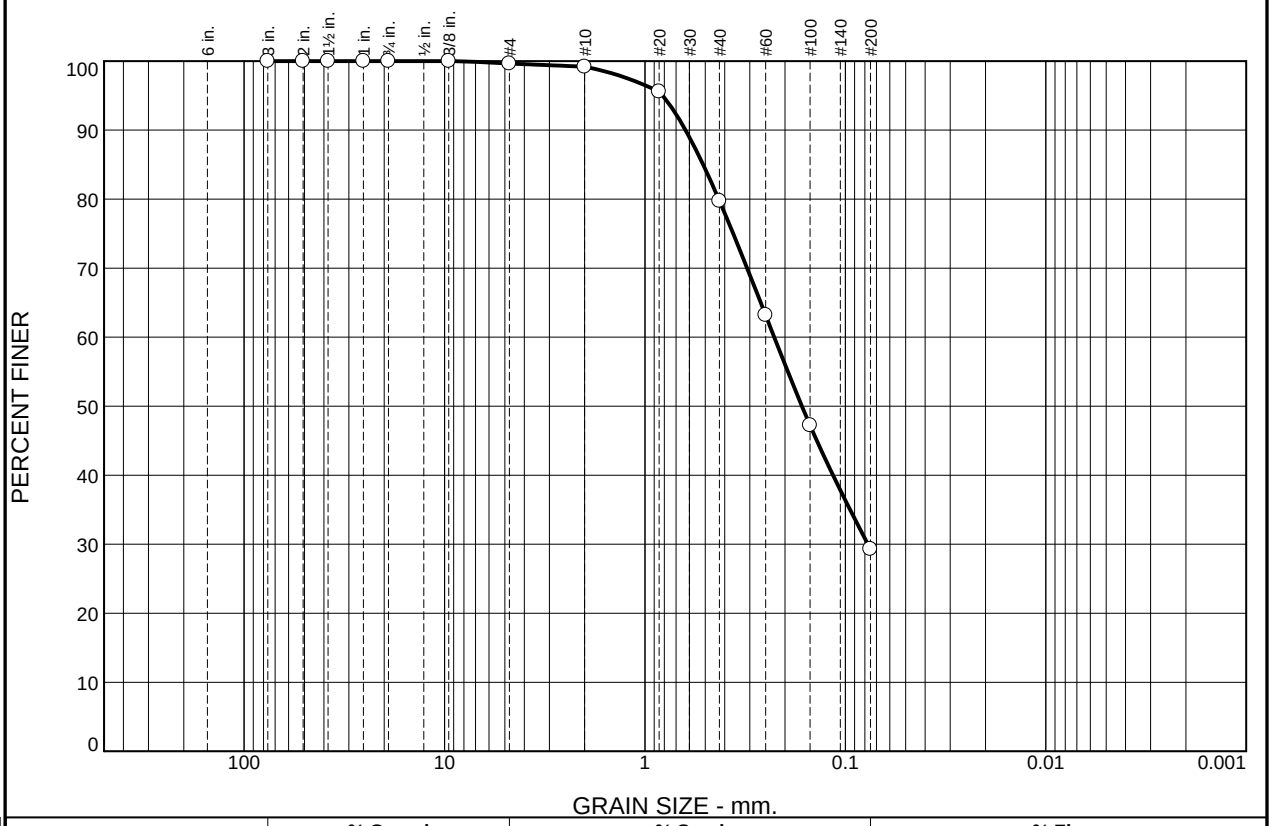
February 2020
J.N.: 18-345

Figure 3

APPENDIX B

SIEVE ANALYSIS TESTS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.4	0.4	19.5	50.4	29.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	99.6		
#10	99.2		
#20	95.6		
#40	79.7		
#60	63.2		
#100	47.2		
#200	29.3		

* (no specification provided)

Material Description

Brown, Silty fine to medium Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.6274 D_{85}= 0.5126 D_{60}= 0.2264
D_{50}= 0.1647 D_{30}= 0.0772 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Source of Sample: Sieve data
Sample Number: P-1

Date: 2-5-20

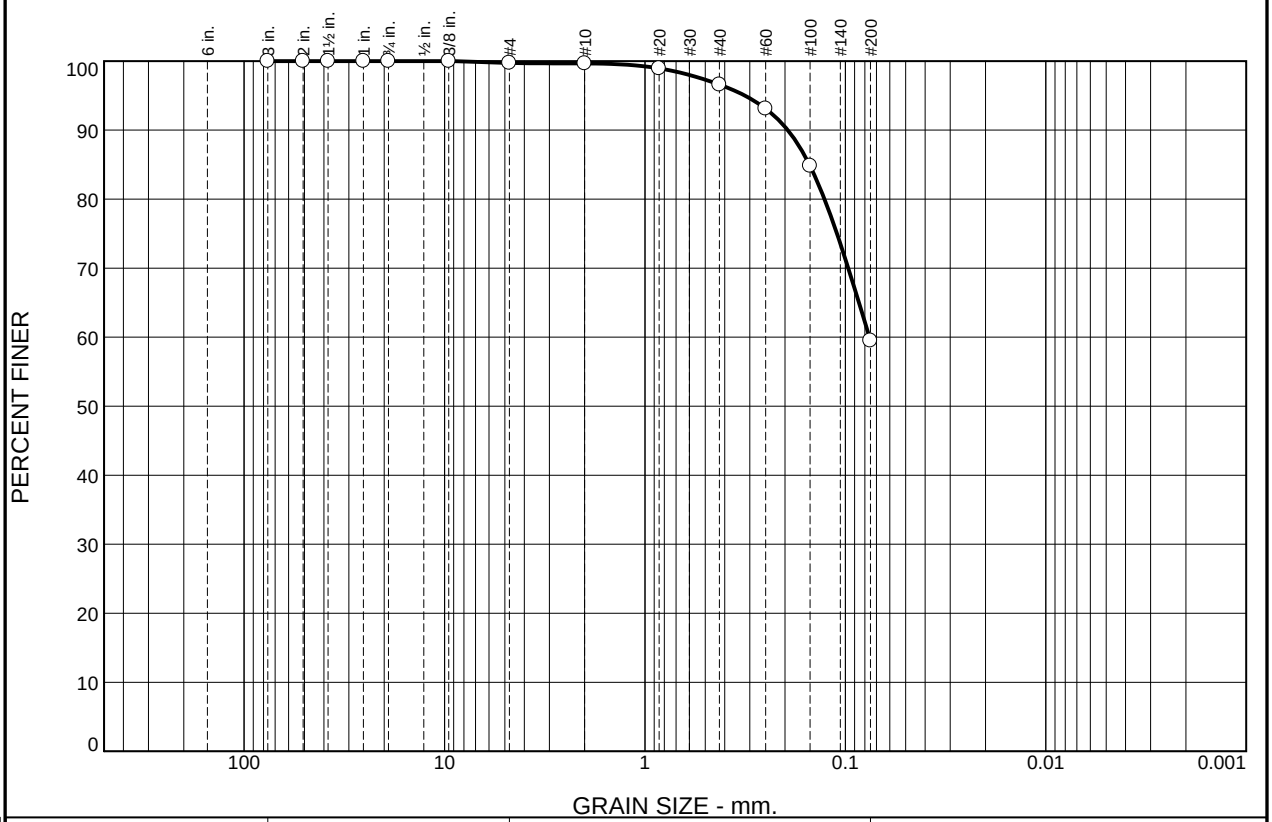
Laboratory:
1251 West Pomona Road, Unit #103, Corona, Ca 92882 Phone #. 714.549.8921

PETRA GEOSCIENCES INC.

Client: MLC Holding
Project:

Project No: 18-345 **PLATE**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.3	0.0	3.1	37.1	59.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	99.7		
#10	99.7		
#20	98.9		
#40	96.6		
#60	93.1		
#100	84.8		
#200	59.5		

* (no specification provided)

Material Description

Olive brown, Silt with fine Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1938 D_{85}= 0.1510 D_{60}= 0.0759
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO=

Remarks

Source of Sample: Sieve data
Sample Number: P-2

Date: 2-5-20

Laboratory:
1251 West Pomona Road, Unit #103, Corona, Ca 92882 Phone #. 714.549.8921

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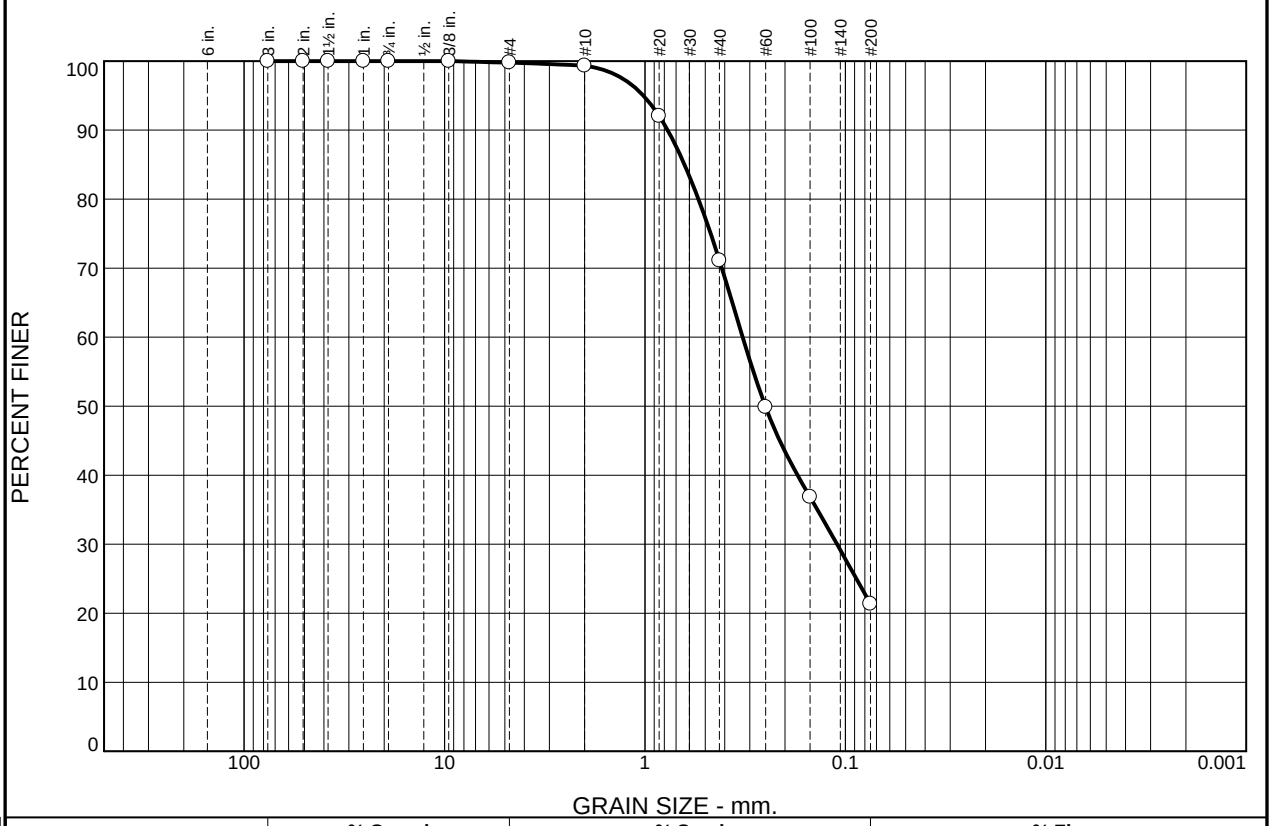
Client: MLC Holding
Project:

Project No: 18-345 **PLATE**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	0.5	28.2	49.7	21.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	99.8		
#10	99.3		
#20	92.0		
#40	71.1		
#60	49.9		
#100	36.8		
#200	21.4		

* (no specification provided)

Material Description

Brown, Silty fine to medium Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.7709 D_{85}= 0.6350 D_{60}= 0.3254
D_{50}= 0.2509 D_{30}= 0.1100 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Source of Sample: Sieve data
Sample Number: P-3

Date: 2-5-20

Laboratory:
1251 West Pomona Road, Unit #103, Corona, Ca 92882 Phone #. 714.549.8921

PETRA GEOSCIENCES INC.

Client: MLC Holding
Project:

Project No: 18-345 **PLATE**